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The printing of this publication has been approved by the Director of the Bureau of the Budget, July 30, 1957.

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ERRATA

NSA Vol. 10, No. 19 Suppl., p. 1053. In abstract 8877, KAPL-M-NGN-1 should be KAPL-M-NGM-1.
NSA Vol. 10, No. 21, p. 1227. In abstract 10511, BMI-746 should be BMI-746(Del.).
NSA Vol. 11, No. 14, p. 792. In abstract 7357, NAVORD-2381 should be NAVORD-4381.
NSA Vol. 11, No. 14 Suppl., p. 823. In abstract 7600, delete $15.30(ph OTS); $5.40(mf OTS).
NSA Vol. 11, No. 15 Suppl., p. 929-930. In abstract 8463, line 10, Pa should be Pd.
NSA Vol. 11, No. 16, p. 985-986. In abstract 8942, John F. Hove should be John E. Hove.
NSA Vol. 11, No. 16, p. 992. In abstract 9000, WADC-TR-57-3 should be USAFIT-TR-57-3.
NSA Vol. 11, No. 18A, p. 1124. In abstract 10228, J. E. R. Holms should be J. E. R. Holmes.

NUCLEAR SCIENCE ABSTRACTS

Volume 12 Number 3 February 15, 1958

GENERAL

2194
ATOMIC ENERGY IN RADIOBIOLOGY. Terminology and Glossary. Selahaddin Goksel and Periham Cambel. Turkish Cancer Radiobiological Society. Publication No. 4. Ankara 1957. 42p. (In Turkish)

A glossary of nuclear science and radiobiology terminology is given in Turkish-English-French, and decay series of U^{235}, U^{238}, and Th^{232} are included. (R.V.J.)

Atomic Bombs and Warfare

Refer to abstract 2200.

Atomic Power

2195
NUCLEAR TECHNOLOGY—SHIP PROPULSION DESIGN WITH GAS TURBINES. K. Illies. Atomkern Energie 2, 368-76(1957) Oct. (In German)

2196
SHIP PROPULSION WITH ENCLOSED GAS TURBINES AND GAS COOLED REACTORS. K. Bammert. Atomkern Energie 2, 381-4(1957) Oct. (In German)

2197
SPECIAL NUCLEAR REACTORS FOR SHIPS. W. Junkermann. Atomkern Energie 2, 385-90(1957) Oct. (In German)

BIOLOGY AND MEDICINE

2198 UCRL-3915
California. Univ., Berkeley. Radiation Lab.
EVOLUTION OF ENZYMES AND THE PHOTOSYNTHETIC APPARATUS. Melvin Calvin. Aug. 26, 1957. 12p. Contract W-7405-eng-48. $0.50(OTS).

A mechanism is proposed for the development of rudimentary catalytic functions into efficient ones leading to enzymes. By use of this development, an analysis is made of the time and stage in prebiological history at which photosynthesis appeared. (auth)

2199
INVESTIGATION OF THE RADIOACTIVITY IN VEGETATION. Walter Herbst, Hans Langendorff, Kurt Philipp, and Kurt Sommermeyer. Atomkern Energie 2, 357-67 (1957) Oct. (In German)

Radiation Effects

2200 NP-6435
Kyoto Univ. Japan.
HEMATOLOGICAL INVESTIGATION OF THE ATOMIC BOMB SUFFERERS IN HIROSHIMA AND NAGASAKI CITY. Takehiko Kikuchi and Gyoichi Wakisaka. 1952. 33p.

2201
EFFECTS OF Co^{60} IRRADIATION ON POTATO TUBER SUSCEPTIBILITY TO MICROORGANISMS. E. N. Mukhin and N. P. Panasenko. Doklady Akad. Nauk S.S.S.R. 115, 1209-12(1957) Aug. 21. (In Russian)

2202
THE INFLUENCE OF β RADIATION ON THE DEVELOPMENT OF AZOTOBACTER AND ITS PHYSIOLOGICAL ACTIVITY. E. N. Sokurova. Mikrobiologia 26, 519-25 (1957) Sept—Oct. (In Russian)

Introduction of small quantities of β emitters into nutritive media on which Azotobacter is grown induced a temporary acceleration of the development of its cultures. (R.V.J.)

Radiation Hazards and Protection

Refer also to abstracts 2232 and 2530.

2203 AECU-3590
General Electric Co. General Engineering Lab., Schenectady, N. Y.
ULTRASONICS FOR RADIOACTIVE DECONTAMINATION. G. E. Henry. Nov. 11, 1957. 30p. $3.30(ph OTS); $2.40 (mf OTS). (57GL337).

Tests have been run to determine in a preliminary fashion whether ultrasonic vibration would be effective in removing mixed radioactive deposits from the inside surface of steel pipes in a heat exchanger. Different frequencies (20 KC/S, 1000 KC/S) have been used at the maximum power levels conveniently attainable. Different liquids were compared for cleaning effectiveness, with and without ultrasonics. Mild stirring of water bath at room temperature produced virtually no cleaning effect on the samples. Ultrasonics in water, at room temperature, gave 50% to 80% cleaning (as defined by gamma ray count) in 15 minutes or less. Certain chemical solutions gave moderate cleaning results without ultrasonics; but the effectiveness of these solutions was greatly enhanced by the addition of ultrasonics. It was found, as expected, that the effectiveness of the sound wave depended rather critically on the method of coupling to the work. (auth)

2204 NYO-4753(Suppl. 2)
New York Operations Office, AEC.
ANNOTATED BIBLIOGRAPHY ON LONG RANGE EFFECTS OF FALLOUT FROM NUCLEAR EXPLOSIONS. Allen G. Hoard. Nov. 1957. 23p. $0.75(OTS).

2205 NYO-4862
New York Operations Office. Health and Safety Lab., AEC.
SUMMARY OF ANALYTICAL RESULTS FROM THE HASL STRONTIUM PROGRAM, JULY THROUGH DECEMBER 1956. John H. Harley, Edward P. Hardy, Jr., Ira B. Whitney, and Merril Eisenbud. Mar. 15, 1957. 44p. $1.25(OTS).

A network of stations was established in 1951 throughout the United States and extended to many parts of the world in 1952 for the purpose of sampling fall-out from nuclear explosions. Gummed films representing a 24-hour collection of fall-out are ashed and counted for β activity which is then extrapolated to Sr^{90} content. Samples of rain

water, tap water, vegetation, bone, milk, urine, fish, and soil collected at various places were also assayed for Sr^{90} content. Analytical results on samples collected from Sept. 1955 through Sept. 1956 are summarized. A fall-out collector is described in which fall-out material collects in a plastic funnel and is passed through a filter and ion exchange column to collect the activity. (For preceding period see NYO-4751.) (C.H.)

2206 WAPD-SC-548

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
HAZARDS TO THE AREA SURROUNDING PWR DUE TO ATMOSPHERIC DIFFUSION OF RADIOACTIVITY. R. F. Valentine. Sept. 1957. 85p. Contract AT-11-1-GEN-14. $2.25(OTS).

Supplemental to WAPD-SC-541.

Results are presented of dosage calculations resulting from dissemination of radioactive contaminants to the atmosphere from the Shippingport reactor following a postulated loss-of-coolant accident. An evaluation is made of the hazards from gamma and beta radiation sustained directly from the passing cloud and from fall-out and rain-out and the hazard resulting from inhalation of radioactive materials. Accumulated ground concentrations are calculated. The evaluation is made basically for four types of accidents; release to the atmosphere of primary coolant containing only corrosion products; release to the atmosphere of primary coolant containing fission products of the blanket UO_2; release of the primary coolant followed by core meltdown and release of the liberated core fission products to the atmosphere through a breached or open plant container; and release of the primary coolant followed by core meltdown and seepage of fission products from an intact plant container. In each case the quantity of fission products assumed to be involved is that amount present after 3,000 hours of operation at a power of 270,000 kw. Any accident which occurs earlier than this would result in a smaller degree of hazard because of the smaller quantity of fission products generated. (auth)

2207

THE IMPORTANCE OF INDUSTRIAL HYGIENE IN PREVENTION OF INJURIES CAUSED BY ATOMIC ENERGY. S. Caccure (Inst. of Indust. Hygiene, Naples). Minerva Nucleare 1, No. 1, 47-9(1957) Jan.-Feb. (In Russian)

Tracer Applications

2208 HW-52287

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
CALCULATION OF MAXIMUM PERMISSIBLE CONCENTRATION IN AIR, $MPC_{(air)}$, FOR Ru^{106} PARTICLES. W. J. Bair. Oct. 1, 1957. 11p. Contract W-31-109-Eng-52. $0.50(OTS).

The calculation of the concentration of $Ru^{106}O_2$ in air that at equilibrium will result in an average dose rate of 0.3 rem/week to the lung of man is presented. Since data from mouse experiments are used the calculations are extrapolated on the basis of differences in organ weights and do not allow for differences in physiology. These calculations necessarily assume uniform distribution of Ru^{106} throughout the lung tissue although it is known that Ru^{106} is retained as particulates following inhalation of insoluble ruthenium oxide particles. An $MPC_{(air)}$ of 5×10^{-9} μc/ml obtained using exponential functions to represent retention is compared with 8×10^{-9} μc/ml obtained using power function equations. (auth)

2209

PROBLEMS RELATED TO RADIOISOTOPE USES IN EXPERIMENTAL AND DIAGNOSTIC TESTS IN ITALY. G. Monasterio. Report presented at the First Congress of the Italian Biological and Medical Nuclear Society. Minerva Nucleare 1, No. 1, 1-3(1957) Jan.-Feb. (In Italian)

2210

USES OF RADIOISOTOPES IN STUDIES OF THE DYNAMICS OF CARDIAC CIRCULATION AND THE IMPORTANCE OF NEW METHODS OF THE SYMPTOMOLOGY OF CARDIAC OUTPUT. G. Gigli, L. Donato, et al. (Medical Clinic, Pisa). Minerva Nucleare 1, No. 1, 6-47(1947) Jan.-Feb. (In Italian)

CHEMISTRY

2211 AECU-3582

Stanford Research Inst., Menlo Park, Calif.
REACTIONS OF TITANIUM WITH WATER AND AQUEOUS SOLUTIONS. Quarterly Report No. 2, (Report No. 5) [for] June 16–September 15, 1957. Fred E. Littman and Franklin M. Church. Oct. 14, 1957. 14p. [For Oak Ridge National Lab.] SRI Project SD-2116. [Contract W-7405-eng-26.] $3.30(ph OTS); $2.40(mf OTS).

(For preceding period see AECU-3531.)

2212 AERE-C/R-1900

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE SOLUBILITY OF SULPHATES IN URANYL SULPHATE SOLUTIONS. A Tentative Discussion. E. Glueckauf. June 1957. 19p.

2213 AGC-AE-37

Aerojet General Corp., Azusa, Calif.
REACTION OF ZIRCALOY-2 WITH WATER AND WITH URANYL SULFATE FUEL SOLUTION. Monthly Progress Report No. 2 [for] August 1 through August 31, 1957. Oct. 1, 1957. 11p. For Oak Ridge National Lab. Contract [W-7405-eng-26], Subcontract 1089. (AGC-L3501-01-2). $3.30(ph OTS); $2.40(mf OTS).

The objective of these investigations is to determine whether the reaction of molten Zircaloy-2 with uranyl sulfate fuel solution (as used in the HRT) is significantly different from the reaction of Zircaloy-2 with water under identical conditions. The scope of the work includes the determination of the violence and extent of the reaction under the following conditions: solid Zircaloy-2 burning in oxygenated water and in oxygenated uranyl sulfate solution at 280°C and 2000 psig; molten Zircaloy-2 spray in water and in uranyl sulfate solution at atmospheric pressure and temperature (using the Aerojet Explosion Dynamometer); molten Zircaloy-2 spray in oxygenated water and in oxygenated uranyl sulfate solution at 280°C and 2000 psig; and molten Zircaloy-2 (in bulk form) in both oxygen-free and oxygenated water at 280°C and 2000 psig, in both oxygen-free and oxygenated uranyl sulfate solution at 280°C and 2000 psig, and in both oxygen-free and oxygenated water vapor at 2000 psig. (auth)

2214 CF-57-3-35

Metal Hydrides Inc. Chemical Research Lab., Beverly, Mass.
THE SODIUM HYDROXIDE–SODIUM OXIDE–SODIUM–SODIUM HYDRIDE–HYDROGEN SYSTEM. Henry C. Kelly, Edward A. Sullivan, and Sidney Johnson. Mar. 7, 1957. Decl. Apr. 1957. 15p. For Oak Ridge National Lab. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40 (mf OTS).

Sodium hydride dissolves in and reacts with molten

NaOH to give an equilibrium mixture of NaH, NaOH, Na_2O, Na, and H. In the case where there is a gaseous phase (hydrogen) and only one condensed phase, the system is defined by the temperature, pressure, and one composition variable. The equilibrium H_2 pressure, which is a measure of the H_2 activity within the melt, was determined as a function of the composition of the condensed phase(s) at 600, 700, and 800° for equilibrium mixtures with original compositions of 2.5 to 97.5, 5.0 to 95.0, 10.0 to 90.0, and 20.0 to 80.0 mole % NaH–NaOH. The equilibrium H_2 pressure–composition isotherms obtained by removing measured increments of H_2 were reproduced by reabsorbing H_2. Results for the 5.0 mole % NaH mixture were duplicated by starting with an equivalent quantity of either Na in NaOH or Na_2O in NaOH, and reacting with measured increments of H_2. The system is discussed in relation to the interdependent reactions involved, the phase rule, the thermodynamics of certain reactions, and experimental techniques employed. (auth)

2215 HW-39945(Suppl.)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
SPONTANEOUS DECOMPOSITION OF TRICHLOROETHYLENE. G. F. Yost. July 30, 1957. 8p. Contract W-31-109-Eng-52. $0.50(OTS).

Additional studies on the stability of trichloroethylene were made to supplement a previous report. Results show that trichloroethylene stabilized with either neutral or alkaline stabilizers can be used safely in degreasing operations, even when the system contains trace amounts of acid. However, tests for measuring degree of decomposition and acid build-up are necessary to insure safe operating conditions. The control tests, which are satisfactory for the metal cleaning processes, are based on the chloride concentration and pH. A control limit of 200 ppm maximum chloride concentration and a minimum pH value of 4.0 were established. These limits were established to give adequate control against decomposition and to prevent excessive corrosion. (auth)

2216 LA-2075
New Mexico. Univ., Albuquerque.
THE EXCHANGE REACTION BETWEEN SUBSTITUTED BENZYL IODIDES AND POTASSIUM IODIDE. VIII. p-METHYLBENZYL IODIDE. IX. p-CARBOMETHOXYBENZYL IODIDE. Milton Kahn and J. L. Riebsomer. Mar. 1957. 18p. For Los Alamos Scientific Lab. Contract [W-7405-eng-36]. $0.75(OTS).

A measurable exchange has been observed in methanol and ethanol between the iodine atom in p-methylbenzyl iodide and the iodide ion in potassium iodide. The exchange reaction was investigated over a temperature range from 0° to 30.9°C. The total iodide concentration in methanol and in ethanol ranged from 0.00123 to 0.00919M and from 0.00141 to 0.00977M, respectively. The rate laws for the exchange reaction are given. A measurable exchange has also been observed between the iodine atom in p-carbomethoxybenzyl iodide and the iodide ion in potassium iodide over the same temperature range. The total iodide concentration in methanol and in ethanol ranged from 0.00134 to 0.00855M and from 0.00135 to 0.00962M, respectively. The rate laws for the eschange reaction are given. A summary of the rate constants, activation energies, frequency factors, and entropies of activation for all the para-substituted iodides studied is presented. (auth)

2217 LWS-24822
California Research and Development Co., Livermore, Calif.
THE ECONOMIC ASPECTS OF HNO_3 RECOVERY FROM DISSOLVER OFF-GASES. J. L. Schwennesen. May 1, 1953. Decl. Sept. 27, 1957. 8p. (CRD-T4C-151). $1.80 (ph OTS); $1.80(mf OTS).

The dissolving of irradiated U is accomplished with the evolution of large quantities of nitrogen oxides. This report is intended to indicate the economic feasibility for recovering the nitrogen oxides or nitric acid as a function of acid value and the tonnage rate of uranium processed in a separations plant. (auth)

2218 NYO-3436
Princeton Univ., N. J.
ELECTRON MICROSCOPE AND OPTICAL STUDIES OF THE REACTION OF CARBON WITH OXYGEN. Thomas J. Streznewski and John Turkevich. Aug. 30, 1957. 21p. Contract AT(30-1)-1301. $4.80(ph OTS); $2.70(mf OTS).

Evaporated C films and C particles obtained by burning benzene in air were subjected to reaction with O atoms produced in a discharge tube. The evaporated film reaction was followed using the optical transmission as a method of determining the rate of erosion of the surface. Rates of erosion of the surface were determined for atom concentrations up to 65%. The rate of erosion of the film is independent of temperature in the range 20 to 100°C and depends directly upon the O atom concentration. The C samples mounted on SiO films were also reacted with O atoms and the change in size distribution was followed by the electron microscope. The mean radius of the particles decreases linearly with time, the half-width of the particle size distribution remains constant. The rate is temperature independent and dependent directly on the concentration of O atoms. Hydrogen atoms also react with C at room temperature while ozone shows no effect. These results were used to develop a method to remove carbonaceous material on electron microscope specimens of automobile exhaust aerosols. (auth)

2219 ORNL-2386
Oak Ridge National Lab., Tenn.
CHEMISTRY DIVISION ANNUAL PROGRESS REPORT FOR PERIOD ENDING JUNE 20, 1957. Oct. 28, 1957. 154p. Contract W-7405-eng-26. $4.00(OTS).

Nuclear Chemistry. Decay and/or level schemes for Sm^{145}, Pm^{145}, Dy^{159}, Br^{84}, K^{84}, and occurrence and half-life of fission-product Tc^{99} are given. Studies of fission product "solubilities" in in-pile loops and effective reactor cross sections in MTR fuel assemblies are reported. Neutron cross sections for U^{235}, Pu^{239}, and Pu^{240} are given. The effect of NO_2^- on Np extraction was studied. Isolation and Chemical Properties of Synthetic Elements. The occurrence, solvent extraction, and chemical properties of Tc and the heat capacities of $KTcO_4^-$ and K_2ReCl_3 were investigated. Chemical Separation of Isotopes. Studies involving O^{18} enrichment in CO_2, NO, and CO exchange systems, enrichment of S isotopes, separation of B isotopes by Anco system, and N^{15} separation are reported. Radiation Chemistry. Radiation effects on alumina catalysis of H_2-D_2 exchange were studied. Other investigations reported on are: benzene vapor retardation of α-ray-induced polymerization of acetylene, effect of Tl^+ on photoreduction of Ce^{4+} in H_2SO_4, γ-ray decomposition of D_2O, radiation-induced formation of NO_2^- from concentrated NO_3^- solutions, and effect of UO_2^{2+} on γ-ray oxidation of $FeSO_4$. Organic Chemistry. Work is reported on the pinacol and amino-alcohol rearrangements, hydrogen/deuterium isotope effect in rearrangement of triarylethylene glycols, stereochemistry of reactions of 1,2,2-triphenylethyl derivatives, isotope fractionation in decarbonylation of HCOOH, preparation of alkyl phosphinates, radiolysis of organophosphorus compounds, dibutyl phosphonoacetic acid, composition of Amsco 125-82, and Th- and U-containing compounds. Chemistry of

Aqueous Systems. Results are given from studies of spectrophotometry of aqueous solutions, emf measurements of HCl solutions at high temperatures and of H_2SO_4 solutions as affected by Ag_2SO_4, a high-temperature isopiestic unit, the system $CuO-UO_3-SO_3-H_2O$, homogeneous catalysis of the H_2-O_2 reaction in aqueous solution, the system SO_3-H_2O, densities of heavy-water liquid and saturated vapor at elevated temperatures, anion exchange studies, ultracentrifugation, temperature coefficients of ion exchange equilibria, solubility of chloroaurates in HCl and LiCl solutions, ThO_2 dispersions, and adsorption on inorganic materials. Chemistry of Corrosion. A review is given of the chief lines of investigation in fundamental electrochemistry related to corrosion. Nonaqueous Systems at High Temperatures. Studies are reported on: heterogeneous isotopic exchange reactions of fluorine-containing compounds, self-diffusion in molten salts, liquid metal–salt solutions, and effusiometric determination of vapor pressure of NaCl and KCl. Chemical Physics. Investigations were conducted in microwave and radio-frequency spectroscopy, neutron and x-ray diffraction, mass spectrometry and related techniques, fundamental vibrational-rotational band of $N^{15}O$, and beam studies in chemical kinetics. (For preceding period see ORNL-2159.) (T.R.H.)

2220 SCNC-185

Sylvania-Corning Nuclear Corp., Bayside, N. Y.
THE PRODUCTION OF THORIUM POWDER BY CALCIUM REDUCTION OF THORIUM OXIDE. N. Fuhrman, R. B. Holden, and C. I. Whitman. Apr. 10, 1957. Decl. May 27, 1957. 128p. Project No. 1875. $19.80(ph OTS); $6.30 (mf OTS).

A report is presented on the development of a process for the preparation of Th powder by Ca reduction of ThO_2. The present scale of production is nominally 11 pounds. The process is capable of producing metal for reactor application from high purity raw materials without a significant pickup of harmful impurities from other sources. The utilization of type 446 stainless steel as the reactor material of construction enables easy breakout of the reduction product without any adverse effect on metal quality. This solution of the breakout problem without the use of a lining constitutes a major improvement over other versions of this method of preparing Th metal. (auth)

2221 WAPD-SC-543

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
ZIRCONIUM–WATER REACTION DATA AND APPLICATION TO PWR LOSS-OF-COOLANT ACCIDENT. B. Lustman. May 1957. 46p. Contract AT-11-1-GEN-14. $1.25(OTS).

Supplemental to WAPD-SC-541.

A study was made of the amount of reaction which would occur between Zr and water, or steam, should the Pressurized Water Reactor core become uncovered while the Zr alloy heats in the core structure, and also of the amount of reaction after the Zr has melted and drips into water. The distribution of the solid and gaseous products of the reaction and the distribution of energy between these products are described. Conclusions are presented which are based on experiments and theory. The literature on reactions of reactive metals with water is consistent with the estimates presented. 39 references. (C.H.)

2222 WAPD-SC-545

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
HYDROGEN FLAMMABILITY DATA AND APPLICATION TO PWR LOSS-OF-COOLANT ACCIDENT. Z. M. Shapiro and T. R. Moffette. Sept. 1957. 28p. Contract AT-11-1-GEN-14. $1.00(OTS).

Supplemental to WAPD-SC-541.

A summary is presented of generalized data on the flammability of hydrogen in steam–air mixtures. The flammability data are applied to a postulated Pressurized Water Reactor loss-of-coolant accident and to estimates of the potential pressure effects on the PWR plant container. (C.H.)

2223 AEC-tr-3074

THE PROBLEM OF THE SOLUBILITY OF BORON AND CARBON IN BORON CARBIDE $B_{12}C_3$ (B_4C). G. S. Zhdanov, G. A. Meerson, N. N. Zhuraveyev, and G. V. Samsonov. Translated from Zhur. Fiz. Khim. 28, 1076-82(1954). 9p.

An investigation is presented of the solubility of B and C in B_4C to clarify the mechanism of solution, taking into consideration in particular the theoretical interest of this solubility of components in a covalent chemical compound such as B_4C. (W.L.H.)

2224

ION EXCHANGE STUDIES OF TRANSGUANYLATION REACTIONS. I. REARRANGEMENT OF S,2-AMINOETHYLISOTHIOUREA TO 2-MERCAPTOETHYLGUANIDINE AND 2-AMINOTHIAZOLINE. Joseph X. Khym, Raymond Shapira, and David G. Doherty (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 79, 5663-6(1957) Nov. 5.

2225

AN INDUSTRIAL-TYPE FLOW CELL FOR MONITORING pH. K. J. Hahn and Karl Koyama (General Electric Co., Richland, Wash.). Ind. Eng. Chem. 49, 63A(1957) Nov.

A flow cell was developed with features especially desirable for use in monitoring pH of radioactive as well as nonradioactive streams. (auth)

2226

REACTION RATE OF SOLID SODIUM WITH AIR. William H. Howland and Leo F. Epstein (Knolls Atomic Power Lab., Schenectady, N. Y.). Ind. Eng. Chem. 49, 1931-2 (1957) Nov.

This study was undertaken to determine the influence of temperature and composition of solid sodium on its rate of reaction with air. A quantitative re-examination was made of the observation that the speed of reaction of alkali metals and air is markedly dependent on purity. The rate of reaction is greater for filtered sodium than for the relatively pure distilled material, particularly at lower temperatures, and the difference between the rates tends to vanish at the melting point of the metal. These experimental results suggest that the reaction is catalyzed by the presence of small amounts of impurity and that the catalysis reaction has a high energy of activation. (auth)

2227

CARBON-14 KINETIC ISOTOPE EFFECTS IN NUCLEOPHILIC SUBSTITUTION REACTIONS. Myron L. Bender and Donald F. Hoeg (Illinois Inst. of Tech., Chicago). J. Am. Chem. Soc. 79, 5649-54(1957) Nov. 5.

The C^{14} kinetic isotope effects in the nucleophilic substitution reactions of methyl iodide-C^{14} with triethylamine, pyridine, hydroxide ion and silver ion have been investigated. The kinetic isotope effects (k_{12}/k_{14}) found in these reactions were 1.10, 1.14, 1.09 and 1.09, respectively. The surprisingly large kinetic isotope effects in these S_N2 reactions are of the same magnitude as many effects noted in reactions proceeding only with bond rupture. A comparison has been made between the observed kinetic isotope effects and those calculated using an equation of Bigeleisen and Wolfsberg for three-center reactions. It appears that the magnitude of the kinetic isotope effect is of only limited use in differentiating between two-center and three-center reactions in nucleophilic substitution (S_N1 and S_N2 reactions). (auth)

2228

THE INFLUENCE OF HIGH OXYGEN PRESSURES ON THE VISCOSITY OF SOLUTIONS OF SODIUM DESOXYRIBONUCLEIC ACID AND OF SODIUM ALGINATE. Daniel L. Gilbert, Rebeca Gerschman, Jules Cohen, and Wade Sherwood (Univ. of Rochester, New York). J. Am. Chem. Soc. 79, 5677-80(1957) Nov. 5.

2229

INVESTIGATION OF THE TERNARY SYSTEMS Mo–Si–B AND W–Si–B AND OF THE SYSTEM VSi_2–$TaSi_2$. H. Nowotny, E. Dimakopoulou, and H. Kudielka. Monatsh. Chem. 88, No. 2, 180-92(1957). (In German)

2230

MEASUREMENT OF THE SATURATED VAPOR PRESSURE OF A He^3–He^4 MIXTURE WITH A HIGH He^3 CONCENTRATION. V. P. Peshkov and V. N. Kachinskii (Academy of Sciences, USSR). Soviet Phys. JETP 4, 607-9(1957) May.

The phase diagrams of the He^3–He^4 mixture at high concentrations of He^3 were constructed. Two series of measurements were carried out for molar concentrations of He^3 in vapor at 97.0 and 94.0%, and in the liquid at about 93.6% in the temperature range from 1.45 to 2.0°K. The separation coefficient was computed from these data. The saturated vapor pressure was found in the vapor from a known concentration by a discontinuity of the pressure composition isotherm. (M.H.R.)

Aerosols

2231 UR-505

Rochester, N. Y. Univ. Atomic Energy Project.

AGGLUTINATION OF SUBMICRONIC DUST PARTICLES WITH A SODIUM CHLORIDE AEROSOL—A TECHNICAL STUDY. L. Dautrebande, K. E. Lauterbach, A. D. Hayes, and P. E. Morrow. Aug. 27, 1957. 30p. Contract W-7401-eng-49. $4.80(ph OTS); $2.70(mf OTS).

This is a preliminary report of a technical study of dust agglutination. Methods and equipment are described which were used in the production of submicronic aerosols of sodium chloride and of several insoluble materials, e.g., aluminum, carbon black and uranium dioxide. Utilizing uranium dioxide as a test aerosol, an agglutinating aerosol of sodium chloride was generated and the two aerosols were mixed in a 2.17 M^3 chamber. At times before and after the mixing of the aerosols, the particle size distribution and concentration of the uranium dioxide aerosol were measured. Special techniques, viz., metallic shadowing and electron vaporization, were coupled with electron-microscopy to facilitate quantitation of the agglutination data. (auth)

Analytical Procedures

2232 AERE-HP/R-2353

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

RADIOSTRONTIUM IN SOIL, GRASS, MILK AND BONE IN THE UNITED KINGDOM: 1956 RESULTS. F. J. Bryant, A. C. Chamberlain, A. Morgan, and G. S. Spicer. Aug. 1957. 33p.

The results of Sr^{90} analysis of soil, grass, and sheep bone from twelve stations in England and Wales are given. The Sr^{90} in the top 4 inches of undisturbed soil in July, 1956 ranged from 1.9 to 10.0 mc/km^2, depending on the rainfall. The Sr^{90} activity of herbage and of sheep bone showed a wider range, samples from acid hill soils being relatively more active. Milk from Somerset had a median activity of 4.4 $\mu\mu c$ Sr^{90} g Ca in 1956, compared with 4.1 in 1955. Human bone specimens obtained in 1956 showed Sr^{90} activity depending on age. The average level in children under 5 was 0.7 $\mu\mu c$ Sr^{90}/g Ca, and the average bone dose 2 mrad/year. (auth)

2233 AERE-I/R-2208

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

RADIOACTIVATION ANALYSIS: A BIBLIOGRAPHY. D. Gibbons, B. A. Loveridge, and R. J. Millett, comps. Aug. 1957. 38p.

This bibliography covers the literature which was available to the compilers, either directly or through published abstracts, up to the end of June 1957. Wherever possible, the original papers have been checked for accuracy of reference and subject matter index. As far as they are known, the originating bodies for reports are given. The references are arranged alphabetically under authors. Papers by the same author are in date order with the latest reference first. The index is in three parts covering (1) reviews and general articles, (2) elements determined, (3) matrices. The index must not be regarded as exhaustive, but only as a guide to all major subjects. (auth)

2234 CF-57-11-33

Oak Ridge National Lab., Tenn.

SPECTROGRAPHIC ANALYSIS OF NORMAL HUMAN TISSUE FROM BALTIMORE, MARYLAND. I. H. Tipton, M. J. Cook, R. L. Steiner, J. M. Foland, K. K. McDaniel, and S. D. Fentress. Nov. 11, 1957. 61p. Contract [W-7405-eng-26]. $10.80(ph OTS); $3.90(mf OTS).

2235 GAT-L-421

Goodyear Atomic Corp., Portsmouth, Ohio.

ION EXCHANGE IN URANIUM ANALYSIS–A LITERATURE SURVEY. C. F. Trivisonno. Nov. 1, 1957. 17p. $3.30 (ph OTS); $2.40(mf OTS).

A literature survey was made on applications of ion exchange in uranium analysis. Topics covered include the absorption of U, the elution of U, and application of ion exchange resins in U analysis. 27 references. (C.H.)

2236 HW-51822

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

STANDARDIZATION OF PLUTONIUM SOLUTIONS BY IGNITION TO THE OXIDE. W. W. Mills. Aug. 5, 1957. Decl. Nov. 7, 1957. 11p. Contract W-31-109-eng-52. $0.25(OTS).

Plutonium solutions can be accurately standardized by the ignition of measured aliquots with excess HNO_3 to a residue of PuO_2 at 1050 to 1100°C. Analytical results were compared with the make-up values of standard solutions prepared from pure Pu metal. Agreement was within ± 0.2% in one case and within ± 0.05% in a second case, for averages of four and five analyses, respectively. It was found that ignitions at temperatures of 1000°C and less resulted in slightly high results indicative of incomplete conversion to PuO_2. (auth)

2237 KAPL-M-ELS-6

Knolls Atomic Power Lab., Schenectady, N. Y.

THE DEVELOPMENT AND TESTING OF A METHOD FOR GAS ANALYSIS IN SAR PRIMARY LOOP WATER. E. L. Shirley. May 21, 1957. Changed from OFFICIAL USE ONLY Oct. 23, 1957. 10p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

A rapid method to determine total dissolved gas and the hydrogen in that gas has been developed for pressurized water systems. The application is particularly suited to shipboard use and gives results in 15 minutes that agree well with the lengthy laboratory method presently used at KAPL. (auth)

2238 UCRL-4944

California. Univ., Livermore. Radiation Lab.

THE DETERMINATION OF LITHIUM HYDRIDE AND LITHIUM HYDROXIDE IN COMMERCIAL-GRADE LITHIUM HYDRIDE. Jack W. Frazer, Carl W. Schoenfelder, and Robert L. Tromp. July 19, 1957. 9p. Contract W-7405-eng-48. $0.50(OTS).

A method is presented for the determination of H_2 in LiH by reacting the sample with boiling Hg and measuring the evolved H_2. The amount of LiOH present is determined by measuring the H_2 evolved from the reaction $LiOH + LiH \rightarrow Li_2O + H_2$. Lithium hydride assays are then obtained from the difference of these two determinations. (auth)

2239 WASH-744

Division of Biology and Medicine. Health Protection Branch, AEC.

IMPROVED MERCURY VAPOR DETECTOR. Thomas S. Ely. Oct. 24, 1957. 10p. $0.50(OTS).

Elemental mercury is a toxic substance, and its volatility makes it a potential inhalation hazard in areas where it is exposed to the atmosphere. The problem is one which confronts the armed forces and other governmental agencies as well as industry. One phase in its evaluation and control is the measurement of airborne mercury vapor concentration. For this purpose several instruments have been devised, most of which are electronic in nature, and indicate concentration essentially instantaneously. One highly desirable attribute of such an instrument, aside from the obvious factors of sensitivity, stability, etc., is portability. All of the existing available instruments which are otherwise satisfactory, fall somewhat short of the portability requirement by being too heavy, depending on house current, or both. (auth)

2240 Y-1178

Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn.

A RAPID DETERMINATION OF MICRO QUANTITIES OF MERCURY IN URINE AND WATER USING THE MERCUROMETER. W. T. McBryde and Fred Williams. Sept. 13, 1957. 12p. Contract W-7405-eng-26. $0.50(OTS).

The mercurometer is a combination of instruments that was assembled to detect mercury in urine and water by measuring the flow of mercury vapors volatilized from a cadmium sulfide-asbestos pad. A more rapid and precise procedure was realized through the use of this instrument. (auth)

2241 AEC-tr-3090

CALCULATION OF THE SPEEDS OF GASEOUS CHEMICAL REACTIONS OCCURRING DURING FLOW. G. M. Panchenkov (Panchenko). Translated from Uchenye Zapiski, Moskov. Gosudarst. Univ. im. M. V. Lomonosova, No. 174, 53-74(1955). 30p.

2242

THIOCYANATE SPECTROPHOTOMETRIC DETERMINATION OF TECHNETIUM. Carl E. Crouthamel (Argonne National Lab., Lemont, Ill.). Anal. Chem. 29, 1756-60 (1957) Dec.

Technetium(VII), when carefully reduced in presence of thiocyanate in an acid medium, forms a red complex with a maximum absorbance at 513 mμ and a molar absorbance index of 52,200 ± 500 at the maximum. A yellow thiocyanate complex also forms with a lower valence state of technetium. (auth)

2243

PRECISION OF THE PYROHYDROLYTIC DETERMINATION OF FLUORIDE AND URANIUM IN URANYL FLUORIDE AND URANIUM TETRAFLUORIDE. James O. Hibbits (Union Carbide Nuclear Corp., Oak Ridge, Tenn.). Anal. Chem. 29, 1760-2(1957) Dec.

The pyrohydrolytic technique for determination of fluoride and uranium in uranyl fluoride and uranium tetrafluoride has been studied to find accuracy and precision obtainable by pyrohydrolysis. Maximum limits of error, at 95% confidence level, for fluoride and uranium were ±0.44 and ± 0.17%, respectively. (auth)

2244

RADIOASSAY OF LOW SPECIFIC ACTIVITY TRITIATED WATER BY IMPROVED LIQUID SCINTILLATION TECHNIQUES. C. A. Ziegler, D. J. Chleck, and J. Brinkerhoff (Tracerlab, Inc., Waltham, Mass.). Anal. Chem. 29, 1774-6(1957) Dec.

Performance of a liquid scintillation method for radioassay of low specific activity tritiated water can be considerably improved by making water sample-scintillation solution ratio optimum and by deoxygenating scintillation solution by ultrasonic degassing. In general, techniques can be applied to radioassay of other water-soluble radioisotopes. (auth)

2245

DETERMINATION OF OXYGEN IN NIOBIUM. W. R. Hansen and M. W. Mallett (Battelle Memorial Inst., Columbus, Ohio). Anal. Chem. 29, 1868-9(1957) Dec.

A diffusion-extraction method developed for determination of oxygen in niobium yields reproducible and accurate results. A 0.5-gram sample is heated at 2000°C, and evolved gases are analyzed by fractional-freezing technique. Mean deviation at 0.019 weight % oxygen level is less than 0.001 weight %. (auth)

Deuterium and Deuterium Compounds

2246 AERE-C/R-2386

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE PREPARATION OF DEUTERIUM SULPHATE. D. E. Glanville. Feb. 1956. Reprinted for sale with amendment, Sept. 1957. 4p.

(Declassified version of HARD(B)/P-4.)

A description is given of the preparation of 250 ml of approximately 6N D_2SO_4 by the dissolution of SO_3 in D_2O. (auth)

Fluorine and Fluorine Compounds

2247

PLATINUM HEXAFLUORIDE. Bernard Weinstock, Howard H. Claassen, and John G. Malm (Argonne National Lab., Lemont, Ill.). J. Am. Chem. Soc. 79, 5832(1957) Nov. 5.

Graphite

2248 ANL-CAB-1

Argonne National Lab., Lemont, Ill.

PREVENTION OF FISSION PRODUCT DIFFUSION. J. E. Wilson. Oct. 22, 1946. Decl. Dec. 9, 1955. 6p. $1.80(ph OTS); $1.80(mf OTS).

The favorable attention being given graphite as a fuel rod material calls attention to the need for preventing diffusion of fission products from the fuel rods. The methods of prevention include painting the surface of the rod with an impermeable organic synthetic composition, enclosing the rods in metal cans, electroplating the rods with a suitable metal, or covering the surface with some type of inorganic ceramic glaze. Each of these methods is evaluated as to feasibility. (M.H.R.)

2249 NP-6479

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

GRAPHITE TECHNOLOGY. Progress Report No. 3 for

the Period August 1, 1957 to October 1, 1957. S. W. Bradstreet. Oct. 1, 1957. 20p. Project No. G-033. Contract AF33(616)-5185.

During the period August 1 through September 30, experimental work has continued on the selection and evaluation of binder materials, on fabrication techniques, and on the carbonizing process. Apparatus has been acquired and is being standardized for differential thermal analysis of binder materials and for measurement of dynamic (sonic) modulus. This report extends the previous general discussion of graphite technology to the fabrication of the green body and its subsequent carbonization. Experimental data are reported on cold-pressing fabrication and on the survey and evaluation of binder materials. On the basis of these data it is concluded that cold-pressing cannot produce high green densities unless a vacuum is applied or a liquid phase is present; since some of the synthetic binders are thermosetting and inelastic, these may be required. Several binder materials have been found to have coke residue values comparable to that of coal tar pitch. These include a phenolic molding compound, a furfuryl alcohol polymer, polyacrylonitrile, and a butyl phenyl phenolic. It is presently believed that Resin C, phenyl-benzaldehyde, and perhaps a purified rosin will also be suitable for further investigation. Maximum green densities were obtained over a broad pressing range when a combined binder of standard pitch and a phenolic molding compound was used. (For preceding period see NP-6418.) (auth)

2250 RDB(R)/TM-16

United Kingdom Atomic Energy Authority. Industrial Group H. Q., Risley, Lancs, England.

THE EFFECTS OF A CHANGE IN GRAPHITE DENSITY. B. Cutts. July 15, 1953. 2p. (AERE-PIPPA-WP/Memo-17).

The effect of a change in graphite density on core enrichment required for PIPPA was studied. (T.R.H.)

2251

NUCLEAR GRAPHITE. HIGHLIGHTS OF THE RECENT SCI SYMPOSIUM. Nuclear Power 2, 466-9(1957) Nov.

Highlights of the recent SCI symposium on graphite in the nuclear power industry are presented. (W.L.H.)

Laboratories and Equipment

2252 ANL-5635

Argonne National Lab., Lemont, Ill.

A SHIELDED METALLOGRAPH FOR REMOTE METALLOGRAPHY. Topical Report—Metallurgy Program 6.10.6. F. L. Brown, L. W. Haaker, S. H. Paine, and R. A. Blomgren. Oct. 1957. 32p. Contract W-31-109-eng-52. $1.00 (OTS).

A unique concept is featured in the adaptation of a Bausch and Lomb Research Metallograph for remote metallography at Argonne National Laboratory. The metallograph is placed outside and adjacent to the metallographic preparation hot cell, and only the microscope section is shielded. This arrangement results in the decisive advantages of simplified adaptation for remote operation, and unaltered optical system, and greatly reduced shielding bulk. A mechanical transfer system shuttles the irradiated specimens between cave and metallograph. All controls and adjustments of the metallograph are available for use in remote metallography; microscope adjustments are manipulated with simple, hand-operated mechanical linkages; stage adjustments are motorized; camera and light source, outside the shield, are operated by hand in the normal manner. The shield, $1\frac{1}{4}$ in. of depleted U incorporated in the stage plus 4 in. of Pb surrounding both microscope and stage, provides for continuous operation with the equivalent of up to 50 c of Co activity. Lead-glass windows permit viewing; a reversible turret and door in the shield cubicle permit easy access to the microscope and stage. (auth)

2253 NP-6478

Brigham Young Univ., Provo, Utah.

I. AN APPARATUS FOR USE WITH CONDENSED PHASES AT 10,000°C. II. SOME THERMODYNAMIC AND RATE CONSIDERATIONS AT VERY HIGH TEMPERATURES. Technical Report for the period June 19, 1956—September 18, 1957. H. Tracy Hall, Billings Brown, Bruce Nelson, and Lane A. Compton. 20p. Contract DA-04-495-ORD-792.

An apparatus is described wherein condensed phases may be heated to temperatures of 10,000°C or higher for second to minute periods. Temperature is obtained by resistance heating of an electrically conducting element confined by a steel bomb. At the highest temperatures of operation, both the heating element and adjacent refractory material are molten. Some consideration is given to the various quantities that determine the equilibria between reactants and products under constant volume and also under constant pressure conditions. Kinetic problems at very high pressure and at very high temperature are discussed. Finally, there is some speculation as to the possibility of forcing external electrons into inner unfilled orbitals when condensed phases are maintained at constant volume and then subjected to extremely high temperatures. (auth)

2254

FACILITIES AND TECHNIQUES FOR ANALYSIS OF HIGHLY RADIOACTIVE SAMPLES. Ralph C. Shank, James E. Rein, George A. Huff, and Fred W. Dykes (Phillips Petroleum Co., Idaho Falls, Idaho). Anal. Chem. 29, 1730-9(1957) Dec.

Techniques used for analysis of highly radioactive samples include dilution of sample, separation of desired constituent, remote analysis, and in-line analysis. There are two types of remote facilities, the "versatile" type for research installations and the "specialized" for rapid routine analyses. Examples are given of both. Remote apparatus and in-line apparatus are described. (auth)

Radiation Chemistry

2255 AERE-C/R-1374(Del.)

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE EFFECT OF PILE RADIATION ON THE CARBON DIOXIDE-GRAPHITE REACTION. P. C. Davidge and W. R. Marsh. Jan. 1956. Decl. with deletions Sept. 3, 1957.

The effect of pile radiation on the decomposition of CO_2 and on the reaction between CO_2 and graphite has been studied in apparatus in BEPO. In the absence of graphite slight decomposition of CO_2 to CO and O was found. In the presence of graphite the formation of CO was greater, no O was found, and the rate of reaction was dependent on the volume of gas irradiated immediately upstream of the graphite. The radiation steady-state carbon monoxide-carbon dioxide composition has been approached from CO_2 rich and CO rich mixtures and, in the apparatus used has been shown to lie between 0.034% and 0.6% CO in CO_2 at a total pressure of one atmosphere. (auth)

2256

SYNTHESES OF BUTADIENE-STYRENE ELASTOMERS AND OF POLYSULFONES BY GAMMA RADIATION. H. Moeremans d'Emaus, Bruce G. Bray, Joseph J. Martin, and Leigh C. Anderson (Univ. of Michigan, Ann Arbor). Ind. Eng. Chem. 49, 1891-6(1957) Nov.

The effect of gamma radiation on the copolymerization of butadiene and styrene and of sulfur dioxide with various unsaturated hydrocarbons has been investigated in preliminary studies using cobalt-60 sources. Small quantities of materials were used in the butadiene-styrene work, and reactions were carried out at room temperature and under vapor pressure of butadiene. Copolymerizations of sulfur dioxide and olefins were carried out on a small scale initially; later on, in larger scale experiments, stainless steel bombs were used. The data are not complete for any range of variable but are presented to show that gamma radiation does affect the reactions involved. (auth)

2257

THE RADIATION CHEMISTRY OF WATER VAPOR. THE INDIRECT EFFECT ON DEUTERIUM AND THE EXCHANGE OF D-ATOMS WITH WATER MOLECULES. Richard F. Firestone (Argonne National Lab., Lemont, Ill.). J. Am. Chem. Soc. 79, 5593-8(1957) Nov. 5.

An investigation of the tritium β-ray induced exchange between deuterium gas and water vapor containing tritium–water has been made in order to measure the radical-pair and water decomposition yields in irradiated water vapor. A value for the radical-pair yield of 11.7 ± 0.6 radical pairs/100 ev has been determined. The exchange takes place via a chain mechanism above 150°. Evidence for the chain-propagating step D + HOH = H + DOH is presented. An apparent activation energy of 18 ± 1 kcal/mole is assigned to this reaction. Results from the radiolysis of pure water vapor indicate an upper limit of 0.02 for $G(H_2)$. (auth)

2258

THE FORMATION OF PEROXYMONOSULPHURIC ACID AND PEROXYDISULPHURIC ACID IN SOLUTIONS OF SULPHURIC ACID IRRADIATED BY ^{60}Co RADIATION. M. Daniels, J. Lyon, and J. Weiss (King's Coll., Newcastle upon Tyne). J. Chem. Soc. 4388-90(1957) Oct.

Radiation Effects

2259 ER-7033-34

Martin (Glenn L.) Co. Materials Lab., Baltimore.

EFFECT OF GAMMA RADIATION ON FM-47 BONDED METAL TO METAL JOINTS AND SANDWICH PANELS. H. Goplin. Sept. 23, 1955. 38p. Appendix 1: EFFECT OF GAMMA RADIATION ON 17-7 STAINLESS STEEL ½ INCH LAP JOINTS BONDED WITH SHELL 422 ADHESIVE. Nov 8, 1955. 3p.

The effect of 10^5 to 10^8 r gamma radiation on aluminum bonded with FM-47 and stainless steel bonded with Shell 422 was studied. (T.R.H.)

Rare Earths and Rare-earth Compounds

2260 NAA-SR-1988

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

AN ESTIMATE OF THE VAPOR PRESSURES OF THORIUM AND PROTACTINIUM. E. W. Murbach. Nov. 1, 1957. 13p. Contract AT-11-1-GEN-8. $0.50(OTS).

Vapor pressures of Th and Pa have been estimated from arc melting data by a method utilizing the following assumptions: (1) ideal solutions of Th with U and Pa, (2) that during the melting operation the entire top surface of the sample button is molten and that this is the area available for volatilization, and (3) that temperature can be determined by measuring the amount of U volatilized, since the vapor pressure of U has been precisely determined. The vapor pressures of Th and Pa were estimated to be 4.2×10^{-6} atmospheres and 5.1×10^{-5} atmospheres at 2200°K. (auth)

2261

PRESENT STATUS OF CERIUM(IV)–CERIUM(III) POTENTIALS. Earl Wadsworth, Frederick R. Duke, and C. A. Goetz (Iowa State Coll., Ames). Anal. Chem. 29, 1824-5(1957) Dec.

Variation of the potential of cerium(IV)–cerium(III) couples with type of anion present is reviewed. Spectrophotometric data on sulfate complex formation and on hydrolysis correlate nicely with potentiometric data, yielding a value of −1.74 volts for E_0 at ionic strength of 2. More work needs to be done in nitrate and chloride solutions. (auth)

2262

THE THERMAL DECOMPOSITION OF YTTRIUM, SCANDIUM, AND SOME RARE-EARTH CHLORIDE HYDRATES. Wesley W. Wendlandt (Texas Tech. Coll., Lubbock). J. Inorg. and Nuclear Chem. 5, 118-22(1957).

The thermal decomposition of Y, Sc, La, Ce, Pr, Nd, Sm, and Gd chloride hydrates was studied on the thermobalance. The salts began to lose water of hydration in the 55 to 110°C temperature range. Horizontal weight levels were found in the decomposition curves which corresponded to the 1-hydrate, metal oxychloride, and in some cases the metal oxide. The thermal decomposition product, in all cases except scandium and cerium, was the metal oxychloride. The minimum temperature limits for the metal oxychlorides ranged from 445 to 680°C. (auth)

2263

PHOSPHATES AND POLYPHOSPHATES OF THE RARE-EARTH ELEMENTS. I. THE HYDROGEN ION DISPLACEMENT METHOD FOR THE CHARACTERIZATION OF THE PHOSPHATES AND POLYPHOSPHATES OF SOME RARE EARTHS. A. G. Buyers, E. Giesbrecht, and L. F. Audrieth (Univ. of Illinois, Urbana). J. Inorg. and Nuclear Chem. 5, 133-40(1957).

Addition of sodium phosphates (and polyphosphates) to rare-earth solutions, both adjusted to a pH of 4.5, results in the precipitation of the normal phosphates (and polyphosphates) corresponding to the formulas RPO_4, $R_4(P_2O_7)_3$, and $R_5(P_3O_{10})_3$, accompanied by displacement of hydrogen ion from the respective ionic species, $H_2PO_4^-$, $H_2P_2O_7$ = and $H_2P_3O_{10}^{-3}$. This displacement reaction has been evaluated for the $H_2PO_4^-$ rare-earth reaction as a method for determination of average atomic weights and has been found to give results which in general are somewhat higher than those based on the accepted oxide-oxalate ratio. Preliminary evidence is also presented to demonstrate that the trivalent rare earths form water-soluble pyrophosphato and triphosphato complexes. (auth)

2264

COMPLEX COMPOUNDS OF RARE-EARTH ELEMENTS. E. A. Terent'eva. Uspekhi Khim. 26, 1007-35(1957) Sept. (In Russian)

The capacity of rare earth elements to form complex compounds was studied with 59 organic and inorganic agents. Experiments confirmed the ability of rare earths to combine into complex compounds and showed that as a rule their capacity to combine improves with decreasing ionic radii. The coordinate number of rare earth elements in trivalent state in most cases equals six. Tetravalent Pr and Ce and in some cases divalent Eu and Sm form complex compounds. However, in contrast to such active metals as Pt, Pd, Fe, and Co the rare earth elements do not form stable complex compounds with Cl^-, NH_3, CN^- and NO. The most stable compounds were formed with organic groups. The stability of the complexes with or-

ganic acids depended on the base and structure of the acid. (R.V.J.)

2265

ON THE SOLVOLYSIS OF NEODYMIUM IONS IN ALCOHOL—AQUEOUS SOLUTIONS. I. S. Pominov (Ul'yanov-Lenin Kazan State Univ.). Zhur. Fiz. Khim. 31, 1926-9 (1957) Sept.

It has been observed that in cases where the water present is not sufficient for complete hydration of all Nd ions, the aqueous and alcohol molecules jointly solvate the rest of the Nd ions. From the absorption spectra of neodymium chlorite alcohol-aqueous solutions it appears that alcohol molecules are not displaced completely from the Nd ion solvate shell by water molecules even when 20 to 30 water molecules per one neodymium chloride molecule are added to the alcohol solution. Some considerations are offered to show why the ratio of water molecules to salt molecules should be so high for a complete displacement of alcohol by water in the Nd^{3+} ion solvate shell. (tr-auth)

Separation Procedures

2266 CF-57-6-61

Oak Ridge National Lab., Tenn.

LIQUID-LIQUID EXTRACTION OF URANIUM AND PLUTONIUM FROM HYDROCHLORIC ACID SOLUTION WITH TRI(ISO-OCTYL) AMINE; SEPARATION OF URANIUM AND PLUTONIUM FROM THORIUM AND FISSION PRODUCTS. Fletcher L. Moore. June 18, 1957 21p. Contract [W-7405-eng-26]. $4.80(ph OTS); $2.70 (mf OTS).

A new and rapid method for the liquid-liquid extraction of U and Pu from HCl solution is based on the use of tri(iso-octyl)amine dissolved in xylene or methylisobutyl-ketone. Uranium and/or Pu are separated from Th, alkalis, alkaline earths, rare earths, Zr, Nb, Ru, and other elements which do not form anionic species under the conditions described. The technique may be used for either tracer or macro quantities of U. Several practical applications of the method for the separations chemist are proposed. (auth)

2267 HW-51958

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

THE EXTRACTION OF NEPTUNIUM(IV) AND PLUTONIUM (IV) FROM NITRIC ACID SOLUTION WITH TRI-N-OCTYL AMINE. John C. Sheppard. Aug. 22, 1957. Decl. Oct. 23, 1957. 13p. Contract [W-31-109-Eng-52]. $3.30 (ph OTS); $2.40(mf OTS).

Tri-n-octylamine conveniently extracts neptunium(IV) and plutonium(IV) from nitric acid solutions. Preliminary experiments to demonstrate the utility of this type of reagent have been performed; in particular the extraction of neptunium or plutonium from Purex waste streams has been demonstrated. Experiments have also been performed to determine what may be expected in the way of fission product decontamination and radiation stability of tri-n-octylamine. Fission product decontamination is not appreciably altered by the organic phase being highly irradiated. This report describes preliminary work designed to determine the solvent extraction characteristics of tri-n-octylamine in the nitric acid system. In particular the solvent extraction behavior of neptunium and plutonium has been investigated. (auth)

2268 IDO-18004(Del.)

Blaw-Knox Co. Chemical Plants Div., Idaho Falls, Idaho.

IDAHO CHEMICAL PROCESSING PLANT DESIGN AND OPERATIONS MANUAL FOR RALA PROCESSING—L CELL. Nov. 1, 1955. Decl. with deletions Sept. 1957. 181p. Contract AT(10-1)-728. (BKC-4289(Del.).)

The RaLa Process was developed for the isolation and recovery of Ba^{140} from irradiated MTR fuel assemblies. Equipment was designed to process one MTR fuel assembly every 30 days and to recover approximately 50,000 c of Ba^{140}/mo. Provisions were also made to transfer the solution containing the uranium from the fuel assembly to a cell for U recovery, and holdup capacity has been provided for solutions containing Sr^{90} so that this fission product can also be recovered if desired after a suitable decay period. Equipment and operation procedures are described. 29 figures. (C.H.)

2269 LA-1699

Los Alamos Scientific Lab., N. Mex.

PLANT-SCALE CONCENTRATION OF Am AND Pu III USING TRIBUTYL PHOSPHATE. W. J. Maraman, A. J. Beaumont, R. S. Day, and R. S. Winchester. Aug. 2, 1954. Decl. Nov. 6, 1957. 13p. Contract W-7405-eng-36. $3.30(ph OTS); $2.40(mf OTS).

Am^{3+} and Pu^{3+} have been recovered on a plant scale by extraction with tributyl phosphate from slag and crucible and other recovery solutions. Process losses were 0.03% Am and 0.01% Pu. The product stream contained 0.08 gram Am per liter and 0.15 gram Pu per liter. The final solution cleanup to allow discard (total alpha activity equivalent to less than 10^{-4} gram Pu per liter) was accomplished by tributyl phosphate extraction of Pu^{3+} under conditions of low acidity and high nitrate. (auth)

2270 ORNL-1993(Rev.)(Del.)

Oak Ridge National Lab., Tenn.

CHEMICAL DEVELOPMENT OF THE 25-TBP PROCESS. J. R. Flanary, J. H. Goode, A. H. Kibbey, J. T. Roberts, and R. G. Wymer. Apr. 9, 1957. Decl. with deletions Sept. 18, 1957. 72p. Contract W-7405-eng-26. $12.30(ph OTS); $4.50(mf OTS).

Laboratory development studies leading to a tributyl phosphate extraction process for recovering U^{235} from irradiated enriched U—Al alloy reactor fuel elements are described. The fuel is dissolved in excess HNO_3, and the solution is digested to eliminate emulsion-forming substances and then extracted with tributyl phosphate, $Al(NO_3)_3$ being the salting agent. The U is stripped with dilute HNO_3 and, after evaporation, is re-extracted in a second cycle. Nitric acid is used as the salting agent in the second cycle. The solvent diluent is pretreated to remove impurities. Procedures for recovering the solvent for process reuse and for reducing the volume of the radioactive $Al(NO_3)_3$ containing waste are proposed. (auth)

2271 ORNL-2301

Oak Ridge National Lab., Tenn.

HYDRAULIC CYCLONES FOR APPLICATION TO HOMOGENEOUS REACTOR CHEMICAL PROCESSING. P. A. Haas. Nov. 29, 1957. 38p. Contract W-7405-eng-26. $1.00(OTS).

Results are reported for studies of application of liquid cyclones, or hydroclones, to removal of 1 to 10-micron particles from aqueous streams. Optimum dimensions were determined, and 0.25 and 0.40-in. diam. units were found to have capacities of 0.2 and 0.5 gpm for 80-ft liquid pressure drops. Under these conditions, hydroclones of these dimensions removed 50% or more of precipitated rare earth sulfates, ZrO_2, or iron oxides (sp. gr. 2.5 to 5) of 1-micron particle size from aqueous streams at 250 to 300°C. Results with 0.16, 0.25, 0.40, 0.50, and 0.56-in. diam. hydroclones were used to extrapolate and test literature correlations of flow capacities and efficiencies. A method of batch underflow accumulation gave heavy-phase concentration factors of up to 4500. Titanium hydroclones

were corroded at rates of 10 mils/year or less in uranyl sulfate solutions containing 10 to 300 g of uranium per kilogram of H_2O at 250 to 300°C. Performance curves were calculated for three sizes of hydroclones designed for use in the Homogeneous Reactor Test Chemical Processing Plant. (auth)

2272

CLOSE pH CONTROL, EASES URANIUM BOTTLENECK. Chem. Eng. 64, No. 12, 150, 152(1957) Dec.

Difficulties at Rare Metals Corporation's resin-in-pulp uranium extraction plant at Tuba City, Arizona were resolved by pH control measures. The filterability of yellow cake precipitate (ammonium diuranate) was improved and the flow of leached ore pulp was speeded up. (T.R.H.)

2273

THE RECOVERY OF THORIUM-230 FROM URANIUM WASTES. D. J. Carswell, J. M. Fletcher, and D. W. Clelland (Atomic Energy Research Establishment, Harwell, Didcot, Berks and U. K. Atomic Energy Authority, Industrial Group, Windscale, Cumb.). J. Inorg. and Nuclear Chem. 5, 147-52(1957).

A solvent extraction with dibutyl carbitol and tributyl phosphate (TBP) cycles has been used to recover Th with a Th^{230} content of 12% from a solid hydroxide waste, containing 6 ppm Th^{230}, which has arisen from the extraction of U from pitchblende. A process consisting of successive counter-current extraction cycles with dilute (5%) and concentrated (40%) TBP which would be of general application to Th^{230} containing wastes, is outlined. (auth)

2274

LIQUID-LIQUID EXTRACTION. PART XII. FLOODING RATES AND PERFORMANCE DATA FOR A ROTARY DISC CONTACTOR. D. H. Logsdail, J. D. Thornton, and H. R. C. Pratt (Atomic Energy Research Establishment, Harwell, Berks). Trans. Inst. Chem. Engrs. (London) 35, 301-15(1957) Oct.

Flood-point data have been obtained for a 3 in. diameter rotary disc contactor using a number of solvent–water systems. The variables studied were the rotor speed, compartment height, and the disc and stator diameters. In the presence of an undistributed solute, it was found that the total throughput increased by 100 to 200% when solute transfer took place from the solvent to the aqueous phase, whereas in the reverse direction of transfer the throughput was reduced by approximately 10% compared with the solute-free system. In the absence of solute, data have been interpreted in terms of the characteristic droplet velocities and these have been correlated with the column geometry and the physical properties. Mass transfer data have been obtained for both directions of transfer using two solvents, i.e. toluene and butyl acetate, with acetone as the solute. It has been shown that the over-all values of the mass transfer coefficient or H.T.U. cannot be split into the individual "film" values, and a new correlation has been obtained in which allowance is made for variations in interfacial area with column geometry and rotor speed. (auth)

2275

LIQUID-LIQUID EXTRACTION. PART XIII. THE EFFECT OF PULSE WAVE-FORM AND PLATE GEOMETRY ON THE PERFORMANCE AND THROUGHPUT OF A PULSED COLUMN. J. D. Thornton (Atomic Energy Research Establishment, Harwell, Didcot, Berks). Trans. Inst. Chem. Engrs. (London) 35, 316-30(1957) Oct.

Flood-point data have been determined for six solvent–water systems using a 3 in. diameter pulsed plate-column. The variables investigated were the plate spacing, plate geometry (i.e. hole-size and percentage free area), and the pulse wave-form. In the latter case, sinusoidal, saw-tooth, and semi-square wave-forms were selected for study. In the absence of an undistributed solute, the data were interpreted in terms of the characteristic velocity which was correlated with the column variables, the physical properties of the system and the pulse characteristics. Mass transfer data were obtained for both directions of transfer using the systems water–toluene and water–butyl acetate with acetone as solute. Overall (H.T.U.) values for a given system were correlated in terms of variations in the interfacial area. (auth)

2276

LIQUID-LIQUID EXTRACTION. PART XIV. THE EFFECT OF COLUMN DIAMETER UPON THE PERFORMANCE AND THROUGHPUT OF PULSED PLATE COLUMNS. D. H. Logsdail and J. D. Thornton (Atomic Energy Research Establishment, Harwell, Berks). Trans. Inst. Chem. Engrs. (London) 35, 331-42(1957) Oct.

Flood-point data have been determined for 6 in. and 12 in. diam. pulsed columns using the systems water–toluene and water–white spirit. Mass transfer measurements, together with a limited number of hold-up measurements, have also been carried out with 6 in., 9 in., and 12 in. diam. columns using the system water–toluene with acetone as solute transferring from the solvent to the aqueous phase. The data were correlated by means of the expressions developed previously for a 3 in. diam. column and it was found that whereas the limiting throughput scaled up geometrically with column diameter, the over-all H.T.U. was proportional to exp. $(d_c/2)$. The application of these results to the design of pulsed plate columns is discussed in detail. (auth)

Spectroscopy

2277 ORNL-2419

Oak Ridge National Lab., Tenn.

THE PREPARATION OF THIN, UNIFORM SOURCES FOR A BETA-RAY SPECTROMETER. Richard L. Blanchard, Bernd Kahn, and R. D. Birkhoff. Dec. 10, 1957 85p. Contract W-7405-eng-26. $2.50(OTS).

Four methods of beta ray spectrometer source preparation were investigated and the quality of the sources produced by each method was determined by autoradiography. Two methods were devised by taking advantage of the colloidal properties of radionuclides. The first radiocolloidal method (the formation of hydroxides and sulfides) produces depositions as high as 82% of the total activity, although, in general, the fractions deposited were much lower. Their uniformity, measured by a densitometer, was 30% to 40%. The second radiocolloidal method (reduction followed by adsorption) produced better results, giving depositions of 90% and greater for many radionuclides and having variations in uniformity of about 1.5%, the highest uniformity obtained. Two methods of electrodeposition were also investigated as possible methods of source preparation. Electrodeposition by an applied emf produced sources having variations in uniformity of 3% to 8% while producing depositions which were nearly complete in almost every case. The sources prepared by internal electrolysis varied in uniformity by about 5% and produced depositions which were from 1% to 8% more complete than the first method of electrodeposition, although about 25% slower. Hence, radiocolloidal adsorption after reduction produced the highest uniformity, but the two methods by electrodeposition were much faster and, in general, produced a higher percentage of deposition. The radiocolloidal method by precipitation should not be omitted from consideration because of the low percentage of activity deposited, for in many cases the

activity deposited would be sufficient, and the uniformity produced would be considerably better than that of solution evaporation. (auth)

Syntheses

2278

SYNTHESIS OF AMINOALKYLISOTHIURONIUM SALTS AND THEIR CONVERSION TO MERCAPTOALKYLGUANIDINES AND THIAZOLINES. David G. Doherty, Raymond Shapira, and W. T. Burnett, Jr. (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 79, 5667-71(1957) Nov. 5.

Transuranic Elements and Compounds

2279 IDO-16403

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

NUCLEAR CONSTANTS AND TECHNICAL REFERENCES RELATED TO PLUTONIUM FUEL SYSTEMS. B. W. Johnson. Sept. 30, 1957. 10p. Contract AT(10-1)-205. $0.50(OTS).

Basic nuclear data for Pu are listed and briefly discussed. Also, a tabulated list of references, which has information pertinent to the use of Pu as a reactor fuel, is given. (auth)

2280

ANALYTICAL CHEMISTRY OF THE ACTINIDES. P. I. Palei. Zhur. Analst. Khim. 12, 647-64(1957) Sept–Oct. (In Russian)

A review is given of the chemical method for separation and determination of the actinides, mainly those used and developed in U.S.S.R. (R.V.J.)

2281

SEPARATION AND DETERMINATION OF PLUTONIUM BY LIQUID-LIQUID EXTRACTION. F. L. Moore and J. E. Hudgens, Jr. (Oak Ridge National Lab., Tenn.). Anal. Chem. 29, 1767-70(1957) Dec.

A rapid and quantitative radioachemical method for separation and determination of plutonium is based on liquid-liquid extraction of plutonium(IV) with 0.5M 2-thenoyltrifluoroacetone in xylene. Plutonium tracer is stripped from organic phase with 10M nitric acid and is recovered free of interferences, both radioactive and nonradioactive. Plutonium recovery is 99 ± 3%. (auth)

2282

EVIDENCE FOR QUADRIVALENT CURIUM. II. CURIUM TETRAFLUORIDE. L. B. Asprey and F. H. Ellinger (Los Alamos Scientific Lab., N. Mex.); S. Fried (Argonne National Lab., Lemont, Ill.); and W. H. Zachariasen (Univ. of Chicago, Ill.). J. Am. Chem. Soc. 79, 5825(1957) Nov. 5.

2283

THE ANALYTICAL CHEMISTRY OF PLUTONIUM. Charles F. Metz (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 29, 1748-56(1957) Dec.

General chemistry of Pu and applications of its analytical chemistry are reviewed. Plutonium may be separated from impurities by precipitation, ion exchange, and solvent extraction. It may be determined by potentiometric titration, spectrophotometric, and radiochemical methods. Spectrochemical methods may be used to determine a large number of metallic impurities. (auth)

Uranium and Uranium Compounds

2284 CRL-45

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

THE PRODUCTION OF UO_2 FOR CERAMIC FUELS. L. C. Watson. Nov. 1957. 30p. (AECL-515).

Presented before the Symposium on Fuel Element Fabrication, Paris, France, November 18-23, 1957.

Uranium dioxide powder suitable for forming and sintering into high density ceramic fuel may be prepared by hydrogen reduction of ammonium diuranate. Some of the variables in the preparation of ammonium diuranate and in its subsequent reduction to UO_2 have been investigated. The aim was to define the conditions for making a readily sinterable UO_2 powder of consistent properties. Ammonium diuranate was prepared by both batch and continuous precipitation. The effect of varying the precipitation conditions was shown by determining the sintered density of the UO_2 pellet prepared from the ammonium diuranate under standard conditions. The effect of varying the reduction conditions was demonstrated. The results show that the sintering properties of the uranium dioxide are insensitive to reduction conditions, but are affected grossly by variations in the ammonium diuranate preparation. Methods of preparing UO_2 which will sinter to a density consistently greater than 10.0 gm/cc are given for both batch and continuous precipitation. Two relatively simple measurements—air permeability and tap density—were made routinely on both ammonium diuranate and UO_2 powders. These measurements can be used to segregate powders of poor sintering characteristics but are not useful in predicting minor differences in sinterability. (auth)

2285 WAPD-TM-36

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

TABULATION OF NEUTRON CROSS SECTIONS FOR U^{235} AND U^{238} AS USED IN THE MUFT-III CODE. R. L. Hellens. Mar. 18, 1957. Decl. Oct. 14, 1957. 7p. $1.80(ph OTS); $1.80(mf OTS).

2286 IGRL-T/C-52

THE PREPARATION OF URANIUM MONOCARBIDE AND ITS BEHAVIOUR COMPARED WITH OTHER HIGH-MELTING CARBIDES. R. Keiffer, F. Benesovsky, and H. Nowotny. Translated by J. Standring from Planseeber. Pulvermet. 5, 33-5(1957). 6p.

Uranium monocarbide is exclusively of interest as a fuel material. UC is easy to produce as a powder of good purity from oxide and nuclear pure carbon. The theoretical carbon content of 4.8% means only an insignificant dilution of the fissionable U^{235} by a nonfissile material. Cubic UC is a high-melting compound (melting point over 2500°) and exhibits no allotropic modifications up to the melting point and, as a result, very probably no anomalies in expansion. No significant decrease in strength of UC moulded bodies occurs up to 1000°C. Spent UC fuel is easily regenerated by an oxidizing treatment. It is considered disadvantageous that compacts of UC, whether sintered or hot pressed, are relatively brittle and do not show a particularly good resistance to thermal shock. (auth)

2287 IGRL-T/C-53

MECHANISM OF FORMATION OF POLYGONISATION SUBSTRUCTURES OBSERVED ON α-URANIUM AFTER HEAT TREATMENT IN THE γ-PHASE. A. Robillard and D. Calais. Translated by H. C. Cowen from Compt. rend. 245, 309-12(1957). 3p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 11, as abstract No. 10504.

2288

INFORMATION ON THE SYSTEMS UC–TiC, UC–ZrC, UC–VC, UC–NbC, UC–TaC, UC–Cr_3C_2, UC–Mo_2C AND UC–WC. H. Nowotny, R. Kieffer, F. Benesovsky, and E. Laube. Monatsch. Chem. 88, No. 3, 336-43(1957). (In German)

Waste Disposal

2289 CF-57-5-24
Oak Ridge National Lab., Tenn.
COMMENTS ON THE TRANSPORTATION OF IRRADIATED FUEL AND RADIOACTIVE WASTES FOR M. LOUIS ARMAND, EURATOM GROUP. F. L. Culler. May 6, 1957. 32p. Contract [W-7405-eng-26]. $6.30(ph OTS); $3.00(mf OTS).

General considerations involving the transportation of irradiated fuel and radioactive wastes are reviewed. It is assumed that many reactors will supply feed to a few large multipurpose chemical plants which ultimately send radioactive waste to a few disposal sites. General economic considerations of irradiated fuel reprocessing, economic aspects of the nuclear economy complex, growth predictions of the nuclear power economy in the U.S., general requirements for the shipment of fuel and waste, regulations applicable to fuel shipments, and permissible radiation levels are discussed. (C.H.)

ENGINEERING

2290 KAPL-M-CFB-2
Knolls Atomic Power Lab., Schenectady, N. Y.
METALLURGICAL EXAMINATION OF CALROD HEATER FAILURE; TEST CALROD NO. 4. C. F. Barrett, Jr. Aug. 8, 1957. 18p. Contract W-31-109-eng-52. $3.30 (ph OTS); $2.40(mf OTS).

A calrod heater was built and tested under Submarine Intermediate Reactor steam-water conditions. The conclusions drawn from metallurgical examination of the failed specimen are given. (T.R.H.)

2291 KAPL-M-SWT-1
Knolls Atomic Power Lab., Schenectady, N. Y.
A GUIDE TO THE SOLUTION OF VIBRATION AND SHOCK PROBLEMS. Sam W. Tagart. May 28, 1957. 78p. Contract W-31-109-Eng-52. $12.30(ph OTS); $4.50(mf OTS).

The "first course" textbooks on vibration problems in engineering necessarily leave a considerable gap between the material covered and some of the practical engineering problems which arise. The purpose of this manual is to demonstrate the use of basic vibration theory in solving a type of vibration problem which is often of considerable practical interest. This problem consists of a typical elastic structure which is fastened to a foundation where the foundation undergoes various excitations. The problem of deterimining possible damage involves obtaining responses of the elastic structure to the more severe types of foundation excitation. It will be assumed that the reader has a basic knowledge of mechanical vibrations and is familiar with matrix notation. A typical problem is worked which involves coupled translation and rotation, and the procedure is general in that it can be easily extended to any number of degrees of freedom for any linear elastic structure with small damping. (auth)

2292 NP-6487
Sanderson and Porter, New York.
DESIGN REPORT—CLOSED CYCLE GAS-TURBINE TEST FACILITY. Feb. 1957. 213p. Project No. 8-97-65-001. Contract DA-44-009-Eng-2562.

Detailed plans and specifications are given for a 400 kev closed cycle gas-turbine power plant test facility. Test equipment and instrumentation are included. (D.E.B.)

2293 SC-4104(TR)
Sandia Corp., Albuquerque, N. Mex.
AIRFLOW CALIBRATION OF THE SANDIA CORPORATION 12-INCH TRANSONIC WIND TUNNEL. Milton W. Davis and Kenneth A. Petersen. June 1957. 49p. Contract [AT(29-1)-789]. $7.80(ph OTS); $3.30(mf OTS).

Centerline axial Mach number distributions for various tunnel configurations and operating conditions are presented, along with calibration equations for speed setting, using the plenum Mach number as a reference. (auth)

2294 WADC-TR-53-426(Pt.5)
Iowa State Coll., Ames.
ORGANO-METALLIC AND ORGANO-METALLOIDAL HIGH-TEMPERATURE LUBRICANTS AND RELATED MATERIALS. [Period Covered] August 1956 to August 1957. Henry Gilman, Richard D. Gorsich, and Bernard J. Gaj. July 15, 1957. 98p. Project Title: RUBBER, PLASTIC, AND COMPOSITE MATERIALS. Task Title: SYNTHESIS AND EVALUATION OF NEW POLYMERS. Contract AF33(616)-3510.

Several novel synthetic procedures have been developed in connection with studies concerned with the preparation of organometallic and organometalloidal compounds to be examined as potential hydraulic fluids and lubricants. The promising cyclic compounds have been extended by making available cyclic Si–M types. Procedures have been developed for the synthesis of non-cyclic unsymmetrical R_3SiM compounds. One of the new developments involving tetrahydrofuran as a solvent in organosilicon chemistry is the stepwise introduction of a wide variety of R groups by reactions between the Si–H group and some RM compounds. This provides the opportunity of synthesizing R_4Si compounds, where all R groups may be unlike, and where there is a maximum promise of obtaining liquids. (For preceding period see WADC-TR-53-426(Pt.4).) (auth)

2295
PURIFICATION OF ATMOSPHERE CONTAMINATED BY NUCLEAR PROCESSES. J. Strach and Z. R. Letnic. Jaderna Energie 2, 331-8(1956). (In Czech)

Descriptions are given of air purification devices for laboratory and industrial buildings contaminated by gases and vapors developed from nuclear processes. (R.V.J.)

2296
BOILERS AND PRESSURE VESSELS FOR NUCLEAR POWER STATIONS. Nuclear Power 2, 463-5(1957) Nov.

The fabrication of pressure vessels, boilers, heat exchangers, and fuelling machines by British companies for nuclear power stations is described. (W.L.H.)

2297
STRESSES IN A PRESSURE VESSEL WITH CIRCUMFERENTIAL RING STIFFENERS. F. W. Catudal and R. W. Schneider (Travelers Indemnity Co., Hartford, Conn.). Welding J. (N. Y.) 36, 550s-2s(1957) Dec.

Most formulas found in pressure-vessel design codes contain factors which compensate, in a very approximate way, for secondary stresses. These factors are often called "factors of ignorance." It is often possible to attain a more effectively balanced design pressure vessel at lower cost and with improved safety by evaluating secondary stresses through a rigorous mathematical stress analysis. This appears to be the trend in pressure-vessel design today. Obviously, this will increase engineering costs and indicates the advantage of having design charts, which will permit the rapid evaluation of secondary stresses, based on pertinent parameters. A chart is presented for the determination of the maximum stress adjacent to a circumferential ring stiffener on a thin-wall cylindrical pressure vessel. It has been assumed that the pressure is internal, acts longitudinally as well as radially and that the ring stiffener spacing is such that the influence of one does not extend to the next. Stresses are given in terms of stress ratio which is the ratio of the total stress

(direct plus secondary) adjacent to the stiffener divided by the hoop stress in the unaffected portion of the shell. (auth)

Heat Transfer and Fluid Flow

2298 AERE-PIPPA-WP/Memo-18

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE EFFECT OF GAS AND FIN METAL THERMAL CONDUCTIVITIES ON HEAT TRANSFER FROM CIRCUMFERENTIALLY FINNED ELEMENTS IN CYLINDRICAL CHANNELS. H. A. Roberts. July 20, 1953. 10p.

Stanton number for circumferentially finned element is shown to be a function of Reynolds number X ratio of thermal conductivities of gas and fin metal. A series of experiments using different fin metals were recorded, the results of which support this relationship. (auth)

2299 AFOSR-TN-57-613

Michigan. Univ., Ann Arbor. Aircraft Propulsion Lab.

REGENERATIVE HEAT EXCHANGER WITH HEAT-LOSS CONSIDERATION. E. K. Dabora. Aug. 1957. 26p. Contract AF18(600)-1199. (ERI-2284-14-T; AD-136603).

The differential equations describing the regenerative type heat exchanger with heat-loss consideration are solved by using Laplace transform. The solution is carried out for two cases: heating the bed from a uniform initial temperature equal to that of the surroundings with fluid at constant inlet fluid temperature, and cooling the bed from a uniform temperature with fluid at constant inlet temperature equal to that of the surroundings. Typical curves of the transient bed temperature are included for both cases. The steady-state temperature in heating is shown to depend solely on the ratio of the heat loss and fluid heat capacity $[(s_0U_0/Gc_p)\cdot x]$; therefore, for any heat-exchanger design where the maximum temperature that can be attained at the exit is of importance, this term should be carefully estimated. (auth)

2300 CF-57-10-118

Oak Ridge National Lab., Tenn.

A STUDY OF BURNOUT HEAT FLUXES ASSOCIATED WITH FORCED-CONVECTION, SUBCOOLED, AND BULK NUCLEATE BOILING OF WATER IN SOURCE-VORTEX FLOW. W. R. Gambill and N. D. Greene. Oct. 29, 1957. 15p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40 (mf OTS).

A study of nucleate boiling of subcooled water in forced-convection source-vortex flow in small diameter horizontal tubes is described. A measured heat flux of 11,000,000 Btu/hr ft^2 was attained, a value 5 times greater than any previously reported for comparable conditions. (T.R.H.)

2301 CF-57-10-128

Oak Ridge National Lab., Tenn.

THERMAL STRESSES IN EXTERNALLY HEATED AND COOLED CYLINDERS. R. D. Cheverton. Oct. 23, 1957. 19p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40 (mf OTS).

2302 CF-57-11-4

Oak Ridge National Lab., Tenn.

RELAXATION CALCULATIONS BY MACHINE FOR TWO-DIMENSIONAL HEAT CONDUCTION PROBLEMS. D. M. Miller. Nov. 1, 1957. 26p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

Relaxation methods for solving complex two-dimensional heat transfer problems were found to be both precise and time saving. Also the method is helpful in solving problems that, because of their complexity, could not be worked analytically. Although the hand computation relaxation method can be used, similar codes for the use of IBM 650 and 704 are available. Due to the probability of error encountered in the many arithmetic processes of hand computation, it is recommended that these problems be solved on these machines, or others of the same general capacity. This report sets forth both the theory and procedure for setting up these problems. A section on the derivation of most of the operators that will be encountered in complex problems and a section on the procedure for setting up these problems for machine computation are included. (auth)

2303 GAT-DM-616

Goodyear Atomic Corp., Portsmouth, Ohio.

COMPARISON OF HEAT TRANSFER COEFFICIENTS OF UNCOATED AND RESIN COATED COPPER CONDENSER TUBES. N. W. Houston. Nov. 6, 1957. 10p. Contract [AT(33-2)-1]. $1.80(ph OTS); $1.80(mf OTS).

2304 HW-52927

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

LITERATURE SURVEY OF FLOW PATTERNS ASSOCIATED WITH TWO-PHASE FLOW. T. W. Ambrose. Oct. 8, 1957. 11p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40(mf OTS).

2305 NP-6476

Massachusetts Inst. of Tech., Cambridge. Heat Transfer Lab.

BURNOUT IN FORCED CONVECTION NUCLEATE BOILING OF WATER. Technical Report No. 10. J. M. Reynolds. July 1, 1957. 18p. DSR Project 7-7673. Contracts N5ori-D7894 and Nonr-1848(39).

Data are presented for burnout in forced convection nucleate boiling of water at pressures above 500 psia. A dimensionless correlation is devised for the M.I.T. data which is found to be valid for certain recent data reported by Argonne National Laboratory. (auth)

2306 NP-6477

Massachusetts Inst. of Tech., Cambridge. Heat Transfer Lab.

DESCRIPTION OF BOILING PROJECT BURNOUT DETECTOR. Technical Report No. 11. M. W. Raymond and J. M. Reynolds. July 1, 1957. 16p. DSR Project 7-7673. Contracts N5ori-07894 and Nonr-1848(39).

The burnout detector design is well suited for research work because of its rapid action and accuracy. The nature of the burnout process under study makes further refinements in its operation unnecessary. The detector and switch have excellent operating records and burnout is invariably prevented quickly enough to avoid measurable effects on the test section. The largest single factor effecting the utilization rate of the unit is the DC amplifier which is somewhat lacking in stability and should be changed to a more stable, commercially available design in future detectors. (auth)

2307 WAPD-TH-344

[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh].

HEAT TRANSFER AND FLUID FLOW PROGRAM OF THE BETTIS THERMAL AND HYDRAULICS SECTION (ADVANCED DEVELOPMENT AND PLANNING ACTIVITIES) FOR PERIOD JULY 1 – DECEMBER 31, 1957. 21p. $4.80 (ph OTS); $2.70(mf OTS).

The heat transfer and fluid flow program which will govern the activities of the Bettis Thermal and Hydraulics Section during the period July 1 through December 31, 1957, is outlined under three general headings, Experimental Boiling Program, Experimental Non-Boiling Program, and Theoretical Studies. (auth)

2308

FILM BOILING OF FLOWING SUBCOOLED LIQUIDS. Eugene I. Motte and Leroy A. Bromley (Univ. of California, Berkeley). Ind. Eng. Chem. 49, 1921-8(1957) Nov.

Heat transfer coefficients outside single horizontal tubes were measured for upward flow forced convection film boiling of ethyl alcohol, benzene, hexane, and carbon tetrachloride. These coefficients were found to be increased markedly by subcooling the liquids below their boiling points. It has been shown previously that heat is transferred across the vapor film by conduction and radiation in forced convection film boiling. Forced convection film boiling occurs when the dimensionless group $U/\sqrt{gD}$ is greater than 2. In this study it has been further shown that, if the liquid is subcooled, heat is transferred from the vapor-liquid interface into the liquid mainly by eddy conduction. Heat transfer by thermal conduction into the liquid appears to be important only at low liquid velocity. (auth)

2309

HEAT TRANSFER IN A HIGH PRESSURE REACTOR. Leon N. Vernon and C. M. Sliepcevich (Univ. of Oklahoma, Norman). Ind. Eng. Chem. 49, 1945-8(1957) Dec.

Heat transfer and fluid flow were studied in a new type of high pressure tubular reactor, which utilizes a machined helix between the liner and body for passage of a heating or cooling fluid. Heat transfer rates for the reactor are very high. Over-all heat transfer coefficients based on the inside area of the reactor were as high as 540 Btu/(hr)(sq. ft.)(°F) for condensation of steam by water. The friction loss for flow through the helix is higher than for straight pipe, because of secondary flow. Pressure drop data indicate that in laminar flow, the friction factor for the coil can be calculated by Prandtl's equation for coiled pipe. (auth)

Materials Testing

2310 AD-121549

Sperry Products, Inc., Danbury, Conn.

CONSTRUCTION AND REFINEMENT OF PROTOTYPE ULTRASONIC INSPECTION EQUIPMENT. Interim Report No. 3 [for] September 1, 1956 to November 30, 1956. Phases I and II. Elliott A. Henry. 59p. Contract AF33 (600)-32131.

The design and construction of a prototype instrument, based upon generation and application of short acoustic impulses (.01 to .25 μsec duration), are described. The loss factors of tandem stress-wave transducers, both acoustic and electrical, are considered with respect to design parameters for more efficient transducers. A "differential" tandem transducer, that provides an electrical output proportional to the difference between the acoustic echo patterns of two adjacent areas of the test specimen, and a simplified inspection system using the differential transducer, is described. The performance, with respect to inspection of adhesive bonded laminates, is partially evaluated. (auth)

2311 SCTM-52-57(16)

Sandia Corp., Albuquerque, N. Mex.

DRY-FILM LUBRICANT STUDIES. L. M. Berry. Mar. 28, 1957. 31p. Contract AT(29-1)-789. (M-6180). $6.30 (ph OTS); $3.00(mf OTS).

Quantitative data on some of the variables affecting the performance of dry-film lubricants are presented. The tests, made on a Falex Lubricant tester show that optimum performance can be obtained only if the variables affecting their use are known and taken into account. (auth)

2312 SCTM-283-56(51)

Sandia Corp., Albuquerque, N. Mex.

EIGHT-YEAR STORAGE PROGRAMS FOR DETERMINING AGING CHARACTERISTICS OF MAINSPRINGS. J. M. Wiesen. Dec. 7, 1956. 8p. Contract AT(29-1)-789. $1.80(ph OTS); $1.80(mf OTS).

A storage program is suggested for estimating the degradation in torque of nominally wound mainsprings. In particular, for each test period in the program, it may be determined whether the degradation has exceeded 5% of nominal. (auth)

2313 TID-3521

Technical Information Service Extension, AEC.

NON-DESTRUCTIVE TESTING. A. Literature Search. Richard J. Smith and Thomas W. Scott, comps. Nov. 1957. 11p. $0.50(OTS).

Bibliographic and availability information is given for 70 AEC reports and 18 non-AEC reports in which are described the following nondestructive testing techniques: sonic, ultrasonic, radiographic, radioautographic, fluorescent penetrant, electromagnetic, frost, eddy current, and leak testing. (auth)

2314 WADC-TR-56-122

Minnesota. Univ., Minneapolis.

EFFECT OF FATIGUE STRESS HISTORY ON ELASTICITY PROPERTIES AND STRESS DISTRIBUTION UNDER ROTATING BENDING. Leonard C. Lidstrom and Benjamin J. Lazan. Aug. 1956. 54p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: FATIGUE PROPERTIES OF STRUCTURAL MATERIALS. Contract AF-33(616)-2803. (AD-97186).

Data are presented on the effect of fatigue stress amplitude and number of cycles on the stress-strain properties of mild steel under reversed axial (tension-compression) stress. Cyclic stress near the fatigue limit is shown to have a significant effect on the stress-strain properties and secant modulus of the material. The general significance of the observed changes in modulus properties on the stress distribution in a rotating beam are discussed. An analytical method is presented for determining the actual or specific stress-strain relationships from the moment-strain data of rotating beam fatigue specimens. This method is used to calculate the specific stress-strain relationships for mild steel, and these are compared with experimentally determined axial stress-strain data. The agreement is found to be good. The actual stress distributions in rotating cantilever-beam fatigue specimens are determined from the specific stress-strain relationships. The errors associated with nominal stress based on the accepted linear stress-strain relationship are analyzed. The effects of magnitude of stress and number of stress cycles on stress distribution are discussed. Fatigue data are presented on solid and hollow rotating beams and under axial stress. These data, compared on the basis of nominal stress, show poor agreement (12 to 30%). However, if compared on the basis of specific or true stress, determined by the methods presented, the agreement is reasonably good (3 to 7%). (auth)

2315

SHOCK-WAVE COMPRESSIONS OF TWENTY-SEVEN METALS. EQUATIONS OF STATE OF METALS. John M. Walsh, Melvin H. Rice, Robert G. McQueen, and Frederick L. Yarger (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 108, 196-216(1957) Oct. 15.

An explosive system is used to drive a strong shock wave into a plate of 24ST aluminum. This shock wave propagates through the 24ST aluminum into small test specimens which are in contact with the front surface of the plate. A photographic technique is used to measure

velocities associated with the 24ST aluminum shock wave and with the shock wave in each specimen. The measured velocities are transformed, using the conservation relations, to pressure-compression points. Resulting pressure-compression curves are given for 27 metals. The range of data is different for each material but typically covers the pressure interval 150 to 400 kilobars; probable errors in reported experimental pressure-compression curves are 1 or 2% in compression for a given pressure. The experimental curves, which consist thermodynamically of a known P, V, E locus for each material, are used to calculate a more complete high-pressure equation of state. This is done by means of a theoretical estimate of the volume variation of the Grüneisen ratio $\gamma(V) = V(\partial P/\partial E)v$. Calculated P, V, T states are listed for the various materials. For 24ST aluminum, quantities of application in shock-wave hydrodynamics are also tabulated. (auth)

MINERALOGY, METALLURGY, AND CERAMICS

Ceramics and Refractories

2316

EMISSIVE PROPERTIES OF ALUMINUM OXIDE AT HIGH TEMPERATURES. V. Ya. Frenkel. Zhur. Tekh. Fiz. 27, 2356-8(1957) Oct. (In Russian)

The integral coefficient of the alundum (sintered Al_2O_3) emission was found to be a slowly increasing function of temperature with magnitude variations from ~0.50 to 0.55 at 1000 to 1600°C. (R.V.J.)

Corrosion

2317 AECU-3581

Stanford Research Inst., Menlo Park, Calif.

REACTIONS OF TITANIUM WITH WATER AND AQUEOUS SOLUTIONS. Quarterly Report No. 1, (Report No. 2) [for] March 15–June 15, 1957. Fred E. Littman and Franklin M. Church. July 11, 1957. 11p. [For Oak Ridge National Lab. Contract W-7405-eng-26.] SRI Project SD-2116. $3.30(ph OTS); $2.40(mf OTS).

A reactor for investigation of the action of oxygenated water on Ti was constructed, which allows examination of these reactions under any conditions up to 300°C and 2000 psi, using either static or dynamic conditions of flow. Rupture disks made of Ti foil 4 to 12 mils thick reacted violently with O_2 at any temperature between 30 to 300°C, if a fresh surface was exposed by breaking the disks. Such disks did not react with water containing up to 2000 ppm O_2, even when a fresh surface was produced. Titanium foil of the same dimensions suspended in the reactor did not react with O_2 at temperatures up to 300°C, as long as no fresh surface was produced mechanically. (auth)

2318 BW-5250

Babcock and Wilcox Co. Research Center, Alliance, Ohio.

CORROSION OF VARIOUS MATERIALS IN HIGH TEMPERATURE WATER. Final Report. L. H. Vaughan and K. Mildred Ferguson. June 25, 1957. 143p. For [Knolls Atomic Power Lab]. Contract NObs-56405, Subcontract N-101.

An investigation of the corrosion and deposition behavior of materials in high-temperature and high-pressure water is presented. The effects of surface treatment and heat treatment on corrosion were investigated. A fretting corrosion test was conducted to evaluate the effects of relative motion or vibration of fuel elements in contact with each other. A detailed metallurgical examination of a number of materials tested is included. (W.L.H.)

2319 CF-55-5-158

Oak Ridge National Lab., Tenn.

MTR-HRP ROCKING BOMB EXPERIMENT ORNL-15. J. R. McWherter. May 24, 1955. Decl. Sept. 1957. 12p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

A study of the effect of high fission density on corrosion of reactor component materials in contact with homogeneous fuel solution is proposed. A small bomb made of the metal to be tested is partially filled with fuel solution and rocked to permit wetting of all surfaces. The bomb is initially pressurized with oxygen and the decrease of this pressure with time is used to determine the corrosion rate. (M.H.R.)

2320 HW-51849

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

OBSERVATIONS ON THE MECHANISMS AND KINETICS OF AQUEOUS ALUMINUM CORROSION. I. THE ROLE OF THE CORROSION PRODUCT FILM IN THE UNIFORM AQUEOUS CORROSION OF ALUMINUM. V. H. Troutner. II. KINETICS OF AQUEOUS ALUMINUM CORROSION. R. L. Dillon. Sept. 30, 1957. 29p. Contract W-31-109-Eng-52. $1.00(OTS).

The role the corrosion product film plays in the uniform penetration corrosion of Al, both as the principal form of corrosion and as a prelude to intergranular attack, is considered. The effects of solution composition and alloy composition are described. (W.L.H.)

2321 NMI-1191

Nuclear Metals, Inc., Cambridge, Mass.

THE AQUEOUS CORROSION OF ZIRCALOY CLAD THORIUM. S. Isserow. Sept. 20, 1957. 25p. Contract AT(30-1)-1565.

Attempts were made to improve the ability of Zircaloy-clad thorium to survive exposure of the core to water entering through small defects in the cladding. The failure of defected specimens was attributed to inadequate core-cladding bonds, which were not improved by an interdiffusion heat treatment. The thorium core may also be so weak as to be the point of failure in bond tests and to crack under the stress induced by the volume expansion on corrosion. Carbon additions hardened the thorium and lowered the corrosion rates. Aging treatments did not increase the hardness, but did increase the corrosion rates. The importance of the core-cladding bond is brought out by the successful protection of Zircaloy-clad uranium alloys against cladding defects. In this case, the interdiffusion heat treatment strengthens the bond sufficiently to permit compaction of oxide. (auth)

2322 NP-6482

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

THE GALVANIC CORROSION PROPERTIES OF TITANIUM AND TITANIUM ALLOYS IN A SALT-SPRAY ENVIRONMENT. D. W. Stough, F. W. Fink, and R. S. Peoples. Oct. 25, 1957. 15p.

It has been found, in galvanic couple tests, that commercially pure Ti and four Ti alloys galvanically accelerate the corrosion of Mg alloys, Al alloys, mild steel, and a straight Cr stainless steel in a salt-spray environment. These same Ti materials showed little or no galvanic effect when coupled to an 18-8 stainless alloy, Monel, or 17-7PH stainless steel in this environment. These experiments also indicated that Ti has slightly less tendency to

promote galvanic corrosion than 18-8 stainless steels when compared under salt-spray conditions. (auth)

2323
NICKEL OXIDATION IN SULFUR DIOXIDE AT HIGH TEMPERATURES. V. V. Ipat'ev and D. V. Zheltukhin. (Kirov Leningrad Forestry Academy). Zhur. Priklad. Khim. 30, 1281-6(1957) Sept. (In Russian)

Data are presented on nickel oxidation kinetics in sulfur dioxide at high temperatures and on the phase and chemical composition of the sinter. The oxidation at 600 to 800° temperature follows the parabolic law. The constant of sinter formation largely depends upon the temperature and has its maximum magnitude at 800°. The rate of oxidation in sulfur is much faster than in the atmosphere. The sinter consists of two phases, NiO and NiS. The reaction proceeds as $3\ Ni + SO_2 = 2\ NiO + NiS$. (R.V.J.)

Geology and Mineralogy

2324
RELATION BETWEEN THE CONTENTS OF RADON AND RADIUM B IN SEVERAL RADIOACTIVE MINERAL SPRINGS. Shunji Umemoto. Bull. Chem. Soc. Japan 30, 421-7(1957) June.

The contents of RaB(Pb^{214}) and other related components were determined immediately after issue in order to disclose the relationship between the contents of Rn and RaB. The measurements were made at Hamamura (Kachimi) Hot Springs, Misasa Hot Springs, and Sekigane Hot Springs, Tottori Prefecture, Japan. (W.L.H.)

2325
PHOTOGEOLOGIC MAP OF THE RAINBOW POINT SE QUADRANGLE, KANE COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-258. J. S. Pomeroy. Washington, U. S. Geological Survey, 1957. $0.50.

2326
PHOTOGEOLOGIC MAP OF THE BUCKSKIN GULCH NE QUADRANGLE, KANE COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-259. R. J. Hackman. Washington, U. S. Geological Survey, 1957. $0.50.

2327
PHOTOGEOLOGIC MAP OF THE BUCKSKIN GULCH SE QUADRANGLE, KANE COUNTY, UTAH, AND COCONINO COUNTY, ARIZONA. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-260. J. P. Minard. Washington, U. S. Geological Survey, 1957. $0.50.

2328
PHOTOGEOLOGIC MAP ON THE EMERY-15 QUADRANGLE, EMERY COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-261. D. Bunnag and G. Moustafa. Washington, U. S. Geological Survey, 1957. $0.50.

2329
PHOTOGEOLOGIC MAP OF THE NOTOM-8 QUADRANGLE, WAYNE COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-262. W. R. Hemphill. Washington, U. S. Geological Survey, 1957. $0.50.

Metals and Metallurgy

2330 AECD-4250
[Los Alamos Scientific Lab., N. Mex.].
MECHANICAL PROPERTIES OF LOW-MOLYBDENUM-URANIUM ALLOYS. E. G. Zukas. May 22, 1956. Decl. Aug. 20, 1957. 4p. Contract [W-7405-eng-36]. $1.80 (ph OTS); $1.80(mf OTS).

Slow cooling rates form ϵ-phase which is deleterious to low temperature properties. For temperatures below ambient, a minimum cooling rate (~2°C/min) is desirable. Rapid cooling rates result in stresses set up by the volume change of the $\beta + \gamma \rightarrow \alpha + \gamma$ transformations. Thus a maximum cooling rate (5°C/min for 1.0 Mo to 30°C/min for 2.0 Mo) must be imposed to circumvent stresses arising from this transformation. Difficulty from the above could be avoided by cooling from γ to 560°C, holding for roughly 1 hour, reheating to 650°C, holding for about one hour, and cooling to room temperature. Several other heat treatments are satisfactory. (auth)

2331 AECU-3578
Ohio State Univ. Research Foundation, Columbus.
SOFT X-RAY SPECTRA OF METALS AND ALLOYS. Annual Report [for] March 16, 1955–March 15, 1956 (Report No. 5). C. H. Shaw. Mar. 15, 1956. 81p. RF Project 471. Contract AT(11-1)-191. $12.30(ph OTS); $4.50(mf OTS).

Measurements and theoretical studies of the characteristic emission and absorption spectra of Ti, Zr, Hf, and Th and their alloys are presented. (W.L.H.)

2332 ARF-2068-4
Illinois Inst. of Tech., Chicago. Armour Research Foundation.
THE SYSTEM ZIRCONIUM–IRON–TIN. Summary Report No. 4 [for] July 1, 1956–June 30, 1957. Lee E. Tanner and David W. Levinson. Aug. 12, 1957. 75p. Project No. B 068. Contract AT(11-1)-315. $12.30(ph OTS); $4.50 (mf OTS).

A series of 94 Zr–Fe, Zr–Sn, and Zr–Fe–Sn alloys was prepared from "Grade 1" iodide Zr and high-purity Fe and Sn by nonconsumable electrode arc melting techniques under an inert atmosphere. The alloy compositions ranged from pure Zr to the first compound in each binary system ($ZrFe_2$ and Zr_4Sn, respectively). The ingots were homogenized to eliminate segregation and degassed to remove H prior to being cut or broken into small specimens and given equilibration anneals at temperatures between 500 and 1100°C. Metallographic examination of the heat treated and quenched samples was the main method for determining the phase relations of this system. X-ray diffraction and visible melting techniques were also employed. The results of this investigation are summarized in binary diagrams, isothermal sections, and vertical sections. (auth)

2333 CF-57-6-74
Oak Ridge National Lab., Tenn.
TRIP TO SELAS CORPORATION OF AMERICA, [MAY 23, 1957, TO DISCUSS INVESTIGATIONS INTO METHODS OF TUBESHEET BRAZING BY DIRECT HEATING]. E. A. Franco-Ferreira. June 18, 1957. 19p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

2334 CF-57-11-11
Oak Ridge National Lab., Tenn.
PRESSURE VESSEL FABRICATION USING T-1 STEEL. E. A. Franco-Ferreira. Nov. 14, 1957. 10p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

The fabrication of pressure vessels using T-1 steel is described. The welding, welding electrodes, explosion-bulge test, and impact and fatigue properties for the pressure vessel are given. (W.L.H.)

2335 CF-57-11-56
Oak Ridge National Lab., Tenn.
ALLOWABLE EXTERNAL PRESSURES FOR ZIRCALOY-2 CYLINDRICAL AND SPHERICAL VESSELS. R. D. Cheverton. Nov. 12, 1957. 5p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

2336 KAPL-M-ARK-1
Knolls Atomic Power Lab., Schenectady, N. Y.
A LITERATURE SURVEY OF MECHANICAL AND PHYSICAL PROPERTIES OF ANNEALED ZIRCALOY-2. A. R. Kerr. Oct. 1, 1957. 53p. Contract W-31-109-Eng-52. $9.00(ph OTS); $3.60(mf OTS).

Mechanical and physical properties of annealed Zircaloy-2 are presented. Tensile, impact, hardness, creep, and fatigue properties over a range of temperatures are included. Some limited data are incorporated on effects of irradiation on Zr and Zr alloys. Data were obtained from a literature survey. (auth)

2337 KAPL-M-JMG-12
Knolls Atomic Power Lab., Schenectady, N. Y.
INVESTIGATION OF CRACKING TENDENCY OF WELDED TIMKEN 16-25-6 ALLOY. J. M. Gerken, R. J. Flint, and D. B. Kittle. Sept. 23, 1957. 9p. Contract W-31-109-eng-52. $1.80(ph OTS); $1.80(mf OTS).

No indications of cracking were found in either segment of welded Timken 16-25-6 alloy. The base metal of both heats was segregated with areas of grain boundary carbides. The material which was heated to 1200°F for 12 hr was more severely segregated. No cracks were found in the segregated areas. (auth)

2338 LM/TAB-5
MSA Research Corp., Callery, Penna.
LIQUID METALS TECHNOLOGY ABSTRACT BULLETIN FOR THE PERIOD JUNE 1 TO OCTOBER 31, 1957. Nov. 11, 1957. 37p.

2339 NAA-AL-1840
North American Aviation, Inc., Downey, Calif.
PROPERTIES OF RESISTANCE SPOTWELDED 24S-T3 AND 75S-T6 ALUMINUM ALLOY SHEET AND 17-7PH STAINLESS STEEL SHEET AT DEPRESSED AND ELEVATED TEMPERATURES. E. J. Pelochino and J. R. Bellah. Feb. 1, 1954. 135p. Project MX-770. W33-038-ac-14191.

Design properties and test results at room, elevated, and depressed temperatures of resistance spotwelded joints are presented. The major portion of the program was devoted to testing clad 24S-T3 and 75S-T6 aluminum alloy sheet and 17-7PH stainless steel sheet in two conditions, THD (hardened and aged) and SA (stretched and aged). Bare 24S-T3, 75S-T6, and clad 61S-T6 aluminum alloy sheet was also tested but for a limited number of gage combinations and temperatures. The results include spotweld shear, tensile, and combined shear and tensile strengths for various temperatures, exposure times, and sheet thicknesses. The shear tests consisted of both equal and unequal gage two sheet joint combinations, plus various multiple sheet combinations up to a four sheet maximum buildup. Tests were also conducted to determine the reduction in parent metal strength in tension for spotwelds at various spacings. All test values are reduced to design values which will afford safe and efficient allowables. (auth)

2340 NACA-TN-4111
Langley Aeronautical Lab., Langley Field, Va.
INVESTIGATION OF THE COMPRESSIVE STRENGTH AND CREEP OF 7075-T6 ALUMINUM-ALLOY PLATES AT ELEVATED TEMPERATURES. William D. Deveikis. Nov. 1957. 30p.

Elevated-temperature compressive-strength test results from room temperature to 600°F and creep test results from 350 to 500°F are presented for V-groove edge-supported plates of 7075-T6 aluminum alloy. The test results are analyzed to verify procedures for estimating maximum strength from material stress-strain curves and creep-failure stresses from isochronous stress-strain curves. The strength and creep results are also compared with similar results for 2024-T3 aluminum-alloy plates. (auth)

2341 NAVORD-3403
Naval Ordnance Test Station, Inyokern (China Lake), Calif.
RELATION OF HIGH-HEATING-RATE TESTS TO VERY-SHORT-TIME CREEP TESTS. W. K. Smith. Mar. 15, 1955. 23p. (NOTS-995).

High-heating-rate curves were derived graphically from a family of very-short-time creep curves for a low-carbon steel. It was found that curves from high-heating-rate tests were displaced to considerably higher temperatures than the derived curves. A special step-temperature, very-short-time creep test revealed the presence of a "delay" in start of creep when prior creep occurred at a lower temperature. This phenomenon was suggested as being responsible for the displacement of the experimental high-heating-rate curves relative to those derived from very-short-time creep curves. It also explained the relatively small effect of heating rate on the yield temperatures in the high-heating-rate tests. The initial delay in creep under certain conditions was believed to be caused by the effect of carbon atoms collected in the substructure boundaries. (auth)

2342 NP-6486
Rensselaer Polytechnic Inst., Troy, N. Y.
RESIDUAL STRESSES IN WELDED TITANIUM PLATES. Final Technical Report. E. F. Nippes and W. F. Savage. Nov. 1957. 48p. Contract DA-20-089-ORD-36696.

The magnitude and type of residual stresses in welded Ti plates were determined by the subdivision technique employing electrical resistance strain gages. Commercially pure Ti plate and 7%–Mn–Ti alloy plate, $\frac{5}{8}$ in. thick, were investigated, welded in both cases with commercially pure Ti filler wire utilizing the inert-gas consumable arc process. The effect of plate dimensions on the residual stresses produced by arc welding commercially pure and alloyed Ti plate was determined. The effect of preheat on the magnitude of longitudinal and transverse residual weld stresses in the alloyed plate was studied. The effects of cold treatment on the weld stresses in commercially pure Ti plate and weld cracking in the 7%-Mn alloy material were determined. (auth)

2343 RDB(C)/TM-233
Gt. Brit. Culcheth Labs., Culcheth, Lancs, England.
TENSILE PROPERTIES OF SOME MAGNESIUM ALLOYS WITHIN THE RANGE 20°C–500°C. F. P. Ellen. Oct. 14, 1954. 8p. (TRDC/P-57).

The tensile tests on Magnox C and E (Mg–Al alloys) were made in a Hounsfield tensometer. For each test a soaking period of one hour at the test temperature was allowed, and the rate of straining was maintained at a value of 0.17 in. per in. per minute. Results of the tests are given graphically. (W.L.H.)

2344 RDB(C)/TM-235
Gt. Brit. Culcheth Labs., Culcheth, Lancs, England.
THE STRESS RUPTURE PROPERTIES OF MAGNOX C AT 200°, 250° AND 300°C. A. Cowan. Nov. 9, 1954. 12p. (TRDC/P-63).

2345 RDB(S)/TM-3331
Gt. Brit. Springfields Works, Springfields, Lancs, England.
A THEORETICAL CONSIDERATION OF THE COMPATIBILITY OF VARIOUS METALS AND ALLOYS WITH MAGNOX. R. D. Stacey. [195?]. 8p.

This memorandum briefly surveys the theoretical aspect

of compatibility, indicating which metals and alloys are potentially dangerous. Initially metals are considered which alloy with Magnox to give phases or eutectics melting below 600°C. Attention is given to the modifications necessary if this limiting temperature is reduced to 575 and 550°C. This latter temperature is the maximum permissible pressurization temperature and should be the maximum temperature the can experiences during its life. (auth)

2346 SEP-224

Sylvania Electric Products Inc. Atomic Energy Div., Bayside, N. Y.

HOT-PRESSING OF ELECTROLYTIC, DEHYDRIDED, AND CALCIUM-REDUCED THORIUM POWDERS. R. H. Witt and H. M. McCullough. Sept. 11, 1956. Decl. Sept. 4, 1957. 37p. Contract AT-30-1-GEN-366. $0.40(OTS).

Hot-pressing variables of time, temperature and pressure were determined for electrolytic, dehydrided and calcium-reduced thorium powders. All powders were found to yield high densities of about 11.50 g/cc when these variables were within the following ranges: a) temperature—625 to 650°C; b) time at pressure—10 to 15 minutes; and c) pressure—12 to 15 tsi. A preforming procedure prior to hot-pressing was found to be effective for thorium powders which had low apparent densities. The results include data on hardness for an evaluation of the densification characteristics of each type of powder. Microstructure of typical hot-pressed samples for each type of powder showed that electrolytic powders contain large grain configurations. Dehydrided and calcium-reduced thorium microstructures showed a thorium matrix with a relatively uniform distribution of impurities, believed to be mainly oxides. (auth)

2347 TID-3508

Technical Information Service Extension, AEC.

UNCLASSIFIED U.S. ATOMIC ENERGY COMMISSION REPORTS ON THE METALLURGY OF ZIRCONIUM AND HAFNIUM. Richard J. Smith, comp. June 1957. 38p. $0.30(OTS).

Annotated references to 134 reports are included covering the following aspects of Zr, Hf, and their alloys: physical and chemical properties, phase diagrams, fabrication, testing equipment and methods, and corrosion. (auth)

2348 TML-82

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

THE PROPERTIES OF TITANIUM ALLOYS AT ELEVATED TEMPERATURES. F. R. Schwartzberg, F. C. Holden, H. R. Ogden, and R. I. Jaffee. Sept. 10, 1957. 286p. Contract AF18(600)-1375.

The elevated-temperature properties of Ti and its alloys are presented and discussed. An attempt was made to present the bulk of currently available information on short-time strengths and creep and rupture properties in a convenient form. Also included is a discussion of thermal stability. (auth)

2349 WADC-TR-54-391

Battelle Memorial Inst., Columbus, Ohio.

INVESTIGATION ON NOTCH SENSITIVITY OF HEAT-RESISTANT ALLOYS AT ELEVATED TEMPERATURE. (RUPTURE STRENGTH OF NOTCHED BARS AT HIGH TEMPERATURES). R. L. Carlson, R. J. MacDonald, and W. F. Simmons. Oct. 1954. 57p. Project No. 7360-73605. Contract AF18(600)-61. (AD-53655).

Stress-rupture tests were conducted on notched and unnotched or plain bars of S-816, Inconel "X" Type 550, and Waspaloy alloys at test temperatures ranging from 1200 to 1600°F. The notched specimens had 50%, 60-degree, V-notches with the root radii ranging from 0.005 to 0.100 in. In some tests, as many as three notches of different root radii were used. The test results indicated that S-816 alloy was notch strengthened by all of the notches used, in the temperature range from 1350 to 1600°F. Inconel "X" Type 550 was always notch strengthened by all of the notches only at the test temperature of 1600°F. Waspaloy was always notch strengthened by all notches only at the temperature of 1500°F. Both Inconel "X" Type 550 and Waspaloy could be notch strengthened for some test conditions (notch sharpness and time) at temperatures below 1600 and 1500°F, respectively. Factors considered to have an influence on stress-rupture behavior were studied and the results are included. The factors investigated are notch geometry, notched and unnotched ductility, the modes of deformation and fracture, metallurgical changes, and surface condition. The influence of some of these factors can vary considerably from alloy to alloy. It does not appear possible, therefore, to evaluate the notch and unnotched stress-rupture behavior of a given alloy completely by any simple method. Rather, an evaluation should be based upon the combined consideration of those factors that are influential in each individual case. (auth)

2350 WADC-TR-54-616(Pt. IV)

Battelle Memorial Inst., Columbus, Ohio.

HYDROGEN CONTAMINATION IN TITANIUM AND TITANIUM ALLOYS. PART IV: THE EFFECT OF HYDROGEN ON THE MECHANICAL PROPERTIES AND CONTROL OF HYDROGEN IN TITANIUM ALLOYS. Period covered: December 1954 to March 1957. D. N. Williams, F. R. Schwartzberg, P. R. Wilson, W. M. Albrecht, M. W. Mallett, and R. I. Jaffee. June 7, 1957. 237p. Project title: METALLIC MATERIALS. Task title: TITANIUM AND TITANIUM ALLOYS. Contract AF33(616)-2813. (AD-131088).

A comprehensive investigation of H_2 in Ti alloys was carried out. Tests were conducted to gain an insight into the mechanism of the slow-strain embrittlement of Ti alloys by H_2, and a tentative theory is presented. Eighty Ti alloys were examined in the stabilized condition to determine the effect of composition on the tendency toward H_2 embrittlement. The effect of microstructural variations on the tendency toward embrittlement was also studied. In addition to studying the effects of H_2 on the properties of Ti, factors affecting hydrogen pickup by Ti and methods of removing H_2 from Ti were investigated. Included were investigations of low pressure solubility, degassing methods, and the pickup of H_2 from various atmospheres. (auth)

2351 WADC-TR-57-374(Pt. II)

National Bureau of Standards, Washington, D. C.

PHYSICAL PROPERTIES OF HIGH TEMPERATURE MATERIALS. PART II. THE HEAT CAPACITY OF ZIRCONIUM, SEVERAL ZIRCONIUM HYDRIDES, AND CERTAIN CLADDING MATERIALS FROM 0° TO 900°C; RELATION TO OTHER THERMODYNAMIC PROPERTIES OF THE Zr – H SYSTEM. [Period covered] June 1955 to September 1955 and June 1956 to July 1957. Thomas B. Douglas and Andrew C. Victor. Aug. 1, 1957. 81p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: THERMAL MEASUREMENTS. Contract AF33(616)-56-21.

Using accurate apparatus and a "drop" method, the heat content (enthalpy) of Zr, five Zr hydrides (N_H from 1.34 to 4.14), and stainless steel type 316 were measured over the range from 0 to 900°C. Using the values for the stainless steel and those from the literature for Mo and Nb, the heat capacities of typical clad samples of the hydrides may be computed additively. Thermal hysteresis of the hydrides was investigated in several cases. Corrections were applied for the impurities in the samples measured,

but the two sets of hydrides gave heat values believed to be somewhat inconsistent in the range 550 to 800°C through systematic differences in phase compositions. The heat content data were extensively correlated with certain published equilibrium data for the Zr–H in order to extend knowledge of the heats of hydriding, equilibrium H_2 pressures, and limits of solid solubility to wider ranges of temperature and composition than those covered by direct measurements. The results are discussed critically, and several structural implications are pointed out. (auth)

2352 WAL-TR-401/284
Watertown Arsenal Lab., Mass.
THE ELEVATED TEMPERATURE CHARACTERISTICS OF INTERNALLY OXIDIZED TITANIUM–CERIUM ALLOYS. Ralph H. Hiltz, Jr. Oct. 1957. 16p. DA Project 5B93-08-021.

Solid solution Ti–Ce alloys, cold rolled to 0.010-inch thickness and annealed, were internally oxidized to produce a fine dispersion of CeO_2 in the Ti matrix. The oxidized alloys were cut into sheet stress-rupture specimens and tested for rupture life at 426, 538, and 648°C. There was noted an improvement in strength over that of pure Ti; the internally oxidized alloys showed curves with a much flatter slope on the log stress-log rupture life plot, characteristic of the stable metal-metal oxide class of alloy. (auth)

2353 WAPD-NCE-1466
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
EVALUATION OF DATA OBTAINED ON "MANUFACTURING PROCESS" DEVELOPMENT BUNDLES PD 1 THROUGH 5 PRIOR TO MACHINING OPERATIONS. W. L. Frankhouser and J. H. Eyler. July 24, 1956. Decl. Oct. 29, 1957. 28p. Contract [AT-11-1-GEN-14]. $4.80 (ph OTS); $2.70(mf OTS).

Five reference fuel rod bundles were welded and evaluated dimensionally. Dimensional data are presented for the as-welded condition and for the annealed bundle with spacer strips removed (prior to the final machining operations). The welding sequence developed for Core Manufacturing should provide "A" boundles in respect to rod spacing measurements. It will probably not be possible to meet the same requirements for water channel averages, because the design tolerances are not consistent with some factors inherent to the production process. A method to improve this situation is presented. The data presented were evaluated in a fashion similar to that which would be used in the proposed scheme. Rods tended to bow resulting in a slightly "barrel-shaped" boundle. It is believed this condition can be overcome by providing special bundle peripheral clamps during annealing. Rod distortion should also be reduced by a redesign and relocation of strip spacers. The new design is proposed. (auth)

2354 AEC-tr-3086
THE EFFECT OF THE SPEED OF THE RESISTANCE OF METALS TO PLASTIC DEFORMATION. L. D. Sokolov. Translated from Zhur. Tekh. Fiz. 16, 437-42(1946). 9p.

Compressions of Pb, Cu, and steel (various C contents) cylinders of height 20 mm were carried out statically (at speeds 0.01 mm/sec and 1 mm/sec) and dynamically (with average speed 2000 mm/sec), both in the cold state and at high temperatures. Curves of the actual stresses were drawn. A relation was found between the speed coefficients, the temperature, and the C content in steel. (auth)

2355
CREEP AND RECOVERY. Cleveland, American Society for Metals, 1957. 376p.

The following papers were presented at a seminar on creep and recovery of metals, held during the thirty-eighth national Metal Congress and exposition: thermal annealing of imperfections in the noble metals; thermodynamics and kinetics of recovery; polygonization; discussion of Hibbard and Dunn paper on polygonization; mechanism of annealing in neutron-irradiated metals; recovery of mechanical properties; recovery of internal friction and elastic constants; concept of creep; theory of creep; role of the boundary in creep phenomena; discussion of Parker and Washburn paper on the role of the boundary; spectrum of activation energies for creep; creep and rupture; and creep of crystalline nonmetals. (W.L.H.)

2356
STRESS CONCENTRATION IN HEAVY-WALLED CYLINDRICAL PRESSURE VESSELS. EFFECT OF ELLIPTIC AND CIRCULAR SIDE HOLES. J. H. Faupel and D. B. Harris (E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.). Ind. Eng. Chem. 49, 1979-86(1957) Dec.

This work was done to establish realistic stress concentration factors for side holes in cylinders. Contrary to intuitive reasoning, the circumferential stress at the cylinder bore-circular side hole interface is intensified by a factor less than 3.0. These factors for both elliptic and circular side holes approach a maximum with increasing ratio of outside to inside diameter of the cylinder and with decreasing size of the side hole; elliptic holes give rise to stress concentrations at the critical location, less than those induced by the presence of circular holes. The practical significance of the results lies in the fact that realistic stress concentration factors can be determined, so that overdesign is avoided. Some vessels heretofore considered impractical can be used with elliptic rather than circular side holes. (auth)

2357
REACTION OF HYDROGEN WITH PREOXIDIZED ZIRCALOY-2 AT 300° TO 400°C. Earl A. Gulbransen and Kenneth F. Andrew (Westinghouse Electric Corp., Pittsburgh). J. Electrochem. Soc. 104, 709-12(1957) Dec.

The permeability of preformed oxide films to hydrogen at 300° to 400°C was studied. Two types of reactions were observed. If the oxide film was permeable, a general reaction occurred with the formation of zirconium hydride phases on the surface. If the oxide film was relatively impermeable, reaction occurred at the edges of the sample where defects probably exist in the oxide. The reaction starts at localized areas and spreads through the metal with hydride and oxide film spalling from the metal continually. (auth)

2358
EXPERIMENTAL WELDING WITH THE CONE ARC. R. E. Monroe and D. C. Martin (Battelle Memorial Inst., Columbus, Ohio). Welding J. (N. Y.) 36, 518s-20s(1957) Dec.

Many of the electrical characteristics of the cone-arc welding process were studied during a program to develop welded molybdenum heat exchangers containing tube-to-header joints. Attempts to eliminate weld irregularities which appeared to be characteristic of the cone arc prompted these studies. Electrode size and shape, electrode centering, type of power source, power-source characteristics and weld circuitry were not found to be associated with the weld irregularities. Further tests showed that the production of uniform welds was primarily a function of even heat transfer around the weld periphery. High-speed motion-picture studies of the arc failed to substantiate the basic cone-arc theory of a rotating ion beam. A modified theory is presented to explain the cone-arc process. (auth)

2359
A NEW NICKEL–BORON PHASE DIAGRAM FOR BRAZING-ALLOY DEVELOPMENT. G. S. Hoppin, III (General Elec-

tric Co., Cincinnati, Ohio). Welding J. (N. Y.) 36, 528s-30s (1957) Dec.

2360

STUDIES OF THE WELD HEAT-AFFECTED ZONE OF T-1 STEEL. E. F. Nippes and W. F. Savage (Rensselaer Polytechnic Inst., Troy, N. Y.) and R. J. Allio (Knolls Atomic Power Lab., Schenectady, N. Y.). Welding J. (N. Y.) 36, 531s-40s(1957) Dec.

2361

HEAT-EXCHANGER FABRICATION. P. Patriarca, G. M. Slaughter, and W. D. Manly (Oak Ridge National Lab., Tenn.). Welding J. (N. Y.) 36, 1172-8(1957) Dec.

Tube-to-tube sheet welding and brazing procedures, which have been incorporated into the fabrication of nickel-base alloy heat exchangers for elevated-temperature service, are described. Vessel portions of these units are assembled entirely by inert-arc welding procedures using trained and qualified welding operators, who must demonstrate ability to consistently produce weldments of the highest quality. Prototype components consisting of compact, relatively complex assemblies of thin-walled small diameter tubing have been extensively tested in simulated service and have performed satisfactorily. It is believed that the principle of welding and back brazing insures maximum reliability, and should be incorporated into heat-exchanger fabrication where leak tightness is mandatory throughout its intended service life. (auth)

2362

THERMAL PROPERTIES OF Pb–Bi ALLOYS IN THE β-PHASE REGION. R. B. Gershman (Gor'kii Kharkov State Univ.). Zhur. Fiz. Khim. 31, 1573-6(1957) July. (In Russian)

The heat of melting and the additional heat capacity in the region of separation have been measured for mixtures in $\alpha + \beta$ solid phases and the pure β phase. Corrections were made in the Pb–Bi constitution diagram in the Pb rich region, and the apparent heats of melting of Pb and Bi in the β phase, as well as their energy of mixing in that phase, have been determined. The values of constants are in good agreement with those predicted from thermodynamic considerations. (tr-auth)

PHYSICS

2363 AECU-3585

RAND Corp., Santa Monica, Calif.

SPACE PLOTS OF PRESSURE, DENSITY AND PARTICLE VELOCITY FOR THE BLAST WAVE FROM A POINT SOURCE IN AIR. H. L. Brode. June 3, 1957. 53p. Contract AT(29-1)-1477. (RM-1913-AEC; AD-133043). $9.30(ph OTS); $3.60(mf OTS).

Supplement to AECU-3517, (RM-1824-AEC).

Graphs of pressure, density and particle velocity versus radius at specified times throughout the course of an explosion in air originating from an instantaneous release of energy at a point are presented. These curves are basic to the results and analysis reported in RAND Research Memorandum RM-1824-AEC and are published as supplementary reference data for those who have occasion to require more information or detail than is presented in that report. (auth)

2364 KAPL-M-RJM-2

Knolls Atomic Power Lab., Schenectady, N. Y.

EVALUATION OF THE HAZARDS FROM A RUPTURE OF THE S3G/S4G NEUTRON SOURCE. R. J. Mazairz. Aug. 26, 1957. 29p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

A Ra–Be startup source is being considered for S3G/S4G in preference to the more commonly used Po–Be neutron source. Since the Ra–Be source has essentially no decay, it would represent a definite cost savings for long operation over the Po–Be source. An analysis was made to determine the radiological hazard resulting from the rupture of a source. The conclusion reached is that since the hazards from either source are essentially equal, there is no preference of sources from a radiological hazard point of view. (auth)

2365 NEPA-1282

Michigan. Univ., Ann Arbor. Engineering Research Inst.

DEVELOPMENT OF APPARATUS AND METHODS FOR MEASUREMENT OF CREEP TO TEMPERATURES OF 3500°F. Progress Report No. 18 [for] December 15, 1949 to January 15, 1950. M. J. Sinnott. Jan. 20, 1950. 7p. Project M781. For Fairchild Engine and Airplane Corp. NEPA Div. Contract [W33-08-ac-14801(16250)].

Some creep data on Material 4811C to 2400°F have been obtained. Creep testing at 3000°F using coated Mo test specimens were attempted but failure in ceramic adaptors resulted. Satisfactory life-tests under intermittent conditions of operation using Al_2O_3 ceramics were obtained in the graphite-induction furnace at a temperature of 3350°F. Schematic circuits of units built for the photo-electron-multiplier temperature controlling unit are presented. (auth)

2366 NYO-7970

New York Univ., New York. Atomic Energy Commission Computing and Applied Mathematics Center.

PROPAGATION OF STRONG BLAST IN AN ATMOSPHERE OF VARYING DENSITY. N. Austern and J. K. Percus. Aug. 15, 1957. 39p. Contract AT(30-1)-1480. $6.30(ph OTS); $3.00(mf OTS).

The engulfed gas, in the propagation of strong shock through a γ-law gas when $\gamma \approx 1$, is confined to a thin shell near the shock surface. Based upon this picture, several models are constructed for the analysis of strong shock propagation in inhomogeneous media. This sequence of models utilizes successively more detailed pictures of the wave behind the shock. In order to assess the validity of the models, comparison is made with a numerical perturbation calculation of a blast in an atmosphere with linear variation of density. It is found that the distortion of the shock front and the distribution of mass per unit shock surface are predicted with considerable accuracy by the models, whereas the transverse mass flow is sensitive to the details of the model picture. (auth)

2367 ORNL-2365

Oak Ridge National Lab., Tenn.

ON THE RELATIONSHIP BETWEEN THE CHARGE OF AN ION AND ITS VELOCITY. Jacob Neufeld. Oct. 29, 1957. 48p. Contract W-7405-eng-26. $7.80(ph OTS); $3.30 (mf OTS).

Methods based on the Bohr–Lamb theory, on the Dmitriev theory, and methods involving studies of charge exchange collisions were correlated with experiments in an attempt to predict the charge of a known ionic species of known energy and moving in a known medium. An attempt was made to establish the possible accuracy of the Bohr–Lamb criterion, which holds that an ion, when passing through matter, is stripped of all its orbital electrons that have velocities smaller than the translational velocity of the ion. Data on ionization potentials obtained by Lisitzin, Mayer, and Finkelnburg were used. A procedure suggested by Knipp and Teller was followed, which introduces two empirical parameters, γ_L and α_L defined as follows: $\gamma_L = v_L/V$ and $\alpha_L = Z_L^{*(1)}/Z_{av}^*$ where V and Z_{av}^*

represent the velocity and the average charge of a moving ion; v_L is the velocity of the most loosely bound electron having a binding charge $Z_L^* = Z_{av}$, and $Z_L^{*(1)}$ is the binding charge that corresponds to the most loosely bound electron having velocity $v_L = V$. (The values v_L and $Z_L^{*(1)}$ have been determined from graphs based on the computations of Lisitzin). The numerical values of γ_L and α_L corresponding to all available measurements of ions of various velocities were determined. The results fail to show any regularity in the behavior of these parameters as a function either of the ionic species or of the ionic velocity or of the surrounding medium. (C.H.)

2368 SCTM-126-57(51)
Sandia Corp., Albuquerque, N. Mex.
HIGH-SPEED MAGNETIZATION VERSUS MAGNETIC FIELD INTENSITY CURVES FOR VARIOUS FERROMAGNETIC MATERIALS. R. W. Kulterman and A. J. Shell. May 17, 1957. 38p. Contract AT-(29-1)-789. $6.30 (ph OTS); $3.00(mf OTS).

A series of ferromagnetic materials was switched from remanent magnetization in one direction to saturation magnetization in the reverse direction. The voltage pulse applied to the cores was a step function 2940 v in amplitude with a rise time of about 5 millimicroseconds. From the data obtained, curves of magnetization versus magnetic field intensity and instantaneous power versus time were plotted. From these curves, values of energy necessary to reverse the flux and the time required to reverse the flux were obtained for each core. On the basis of the above data, there is a discussion of the advantages of the different materials as applied to the explosive-to-electric transducer. (auth)

2369 SCTM-301-57(14)
Sandia Corp., Albuquerque, N. Mex.
THEORY OF SHUNT-TUNED THREE-WIRE MONOPOLE. C. W. Harrison, Jr. Oct. 23, 1957. 22p. Contract AT-(29-1)-789. $4.80(ph OTS); $2.70(mf OTS).

A formula is developed for the driving-point admittance of a shunt-tuned three-wire monopole. The coplanar wires comprising the antenna are of the same radius and are equally spaced. The center wire is grounded. One of the outer wires is base driven; the other is base loaded by a tuning reactor. Measurements demonstrate that if one leg of a three-wire monopole is base tuned, the length dimension of the structure may be decreased with little sacrifice in bandwidth. (auth)

2370 UNM-TR-EE-8
New Mexico. Univ., Albuquerque. Engineering Experiment Station.
REFLECTION AND SCATTERING COEFFICIENTS FOR SEVERAL TYPES OF TERRAIN. Allen R. Edison. Sept. 1957. 17p. For Sandia Corp. Contract [AT(29-1)-789]. $3.30(ph OTS); $2.40(mf OTS).

Reflection and scattering coefficients calculated from radar data taken at near vertical incidence are presented for several targets. The method used in computing and plotting the results is developed and discussed. (auth)

2371
ELECTRICAL CONDUCTIVITY OF PLEXIGLAS. R. J. Munick (Hughes Research Labs., Culver City, Calif.). J. Appl. Phys. 28, 1302-3(1957) Nov.

The electrical conductivity of Plexiglas in an electric field of 2.6 kv/cm in the temperature range from 21 to 90°C was found to be represented by the sum of two exponentials, which have activation energies of 1.45 and 2.7 ev. At the higher temperatures the curves of current as a function of electric field strength from 2.6 to 29 kev/cm were resolved into the sum of a linear and an exponential term. The results suggest that ionic conduction dominates at low fields. (auth)

2372
CZECHOSLOVAK–POLISH CONFERENCE ON NUCLEAR ENERGY. Mieszystlaw Arkuszewski. Nukleonika 2, No. 1, 197-206(1957). (In Polish)

Proceedings are given of the Czechoslovak–Polish Conference on Nuclear Energy, which took place in the Institute of Nuclear Research, Sept. 24-30, 1957. (R.V.J.)

2373
ELECTRON ENERGY BANDS IN CESIUM. Joseph Callaway and Ernst L. Haase (Univ. of Miami, Coral Gables, Fla.). Phys. Rev. 108, 217-21(1957) Oct. 15.

The orthogonalized plane wave method and the cellular method have been applied to a calculation of electronic energy levels in cesium. The same crystal potential was used for all states. Wave functions of core electrons, required in the application of the orthogonalized plane wave method, were determined for this potential. The cohesive energy was calculated according to a simple model. The magnitude at a nucleus of the wave function of an electron on the Fermi surface was estimated by perturbation theory. The energies of twenty-four states at four symmetry points of the Brillouin zone have been obtained. The bands inferred from these results are compared with those in other alkali metals. (auth)

2374
ANGULAR CORRELATION OF ANNIHILATION RADIATION IN ALKALI HALIDE CRYSTALS. W. E. Millett and R. Castillo-Bahena (Univ. of Texas, Austin). Phys. Rev. 108, 257-62(1957) Oct. 15.

A new type of instrument has been used for measurements on Mg metal and single crystals of LiF, NaCl, KCl, KBr, and KI. The data, after correction for instrument resolution, yield the momentum distribution of either the photons or the center of mass of the positron and electron just prior to annihilation. The momentum distribution obtained for NaCl is accounted for by assuming (a) that the positron is bound to the chloride ion in an s state, (b) that annihilation takes place with one of the electrons of the closed shell, and (c) that the overlap wave function is of the form $(r-b)^2e^{-mr}$. Best agreement with experiment was obtained for 30% of the annihilations taking place with s electrons for which b = 0.75 A, and m = 3.64 A^{-1} and the other 70% with p electrons for which b = 0.70 A and m = 4.00 A^{-1}. (auth)

2375
LOW-TEMPERATURE THERMAL EXPANSION OF COPPER. R. O. Simmons and R. W. Balluffi (Univ. of Illinois, Urbana). Phys. Rev. 108, 278-80(1957) Oct. 15.

A rotating single-crystal back-reflection x-ray diffraction technique has been used to measure the thermal expansivity of copper. Values of the linear thermal expansion coefficient are derived at low temperature where disagreement exists in the literature. A possible decrease in the Grüneisen parameter γ for copper exists near 40°K. The decrease reported in the present work is much less marked than previously reported from capacitor dilatometer work, however. It is suggested that large apparent decreases in γ at low temperature reported from similar measurements on Al, Fe, Ag, and KBr may be in error. (auth)

2376
VARIABLE AND REVERSIBLE MAGNETIC FIELDS OBTAINED FROM A PERMANENT MAGNET. John A. Dalman and Leonard S. Goodman (Argonne National Lab., Lemont, Ill.). Rev. Sci. Instr. 28, 961-2(1957) Nov.

The inherent stability of permanent magnets coupled with

the convenience of freedom from sources of electric current has obvious advantages in the laboratory. The author describes a novel arrangement of magnetic materials which makes possible the attainment of a variable and reversible magnetic field from a permanent magnet. (A.C.)

2377

TWO ELECTRON CHARGE EXCHANGE α-PARTICLES IN HELIUM. V. I. Gerasimenko and L. N. Rosentsveig (Academy of Sciences, Ukrainian SSR). Soviet Phys. JETP 4, 509-11(1957) May.

The cross section for capture of two electrons by a fast α particle colliding with a He atom is calculated in the Born approximation. (auth)

Aerosols

2378

THE USE OF MICROPHOTOMETERS IN QUANTITATIVE ANALYSIS OF AEROSOLS. K. P. Makhon'ko (Rostov-on-Don State Univ.). Izvest. Akad. Nauk S.S.S.R. Ser. Geofiz 1164-72(1957) Sept. (In Russian)

The utilization of microphotometers for measuring microscopic particles and for recording the dust distribution on the surfaces of dust catching instruments is described. The objective colorimetric method of detecting dust particle concentrations in the air is also reported. (R.V.J.)

Cosmic Radiation

2379

INTERACTIONS OF HIGH ENERGY PARTICLES WITH NUCLEI. A. P. Zhdanov, I. B. Berkovich, et al. (Khlopin Radium Inst.). Dokaldy Akad. Nauk S.S.S.R. 115, 1093-6 (1957) Aug. 21. (In Russian)

The mechanism of the elementary particle production in nucleon-nuclei interactions in the energy range 10^{11} to 10^{13} ev was investigated. Data are given on the studies made with seven shower streams with a relatively large number of shower particles, formed during the nucleon interactions with nuclei in emulsions irradiated for 7 hr at 30 km elevation. The selected streams formed by neutral and charged particles were divided into two groups, one group having a narrow cone and symmetric integral distributions and the second having a considerably larger cone and larger number of charged particles. Diagrams are given of the angular distribution of shower particles in spallations of the investigated streams. (R.V.J.)

2380

ARRIVAL DIRECTIONS OF COSMIC-RAY AIR SHOWERS FROM THE NORTHERN SKY. George W. Clark (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 108, 450-7(1957) Oct. 15.

The celestial arrival directions of 2660 air showers of size greater than 10^5 particles at sea level have been determined with an angular resolution of 4°. The observations were made by the method of fast timing, and they cover a band of declination from 10° to 90° north. No significant deviation from isotropy of the primaries of these showers has been found. The response of the array to showers of various sizes and arrival directions has been evaluated theoretically and the results are given. The zenith angle dependence of the counting rate indicates an exponential attenuation with atmospheric depth of the intensity of showers at sea level with an attenuation length of 107 ± 11 g cm^{-2}. As a by-product of the experiment a value for the absolute intensity of showers of size greater than 10^5 particles in the vertical direction at sea level is $(9.6 \pm 3.0) \times 10^{-11}$ cm^{-2} sec^{-1} $sterad^{-1}$. (auth)

2381

INFLUENCE OF THE EARTH'S MAGNETIC FIELD ON THE SPACE-DISTRIBUTION OF PARTICLES IN EXTENSIVE AIR SHOWERS. S. I. Nikol'skii and I. E. Satsevich (Academy of Sciences, USSR). Soviet Phys. JETP 4, 589-91(1957) May.

Crystallography and Crystal Structure

2382 NMI-1189

Nuclear Metals, Inc., Cambridge, Mass.

ON THE DETERMINATION OF TWIN INDICES. E. J. Rapperport and W. L. Lees. Sept. 27, 1957. 34p. Contract AT(30-1)-1565. $1.00(OTS).

Two methods are presented for deriving the twin indices from measurements on the surface of a twinned crystal. Both define the twinning shear in terms of angles characterizing the deformation either of two adjacent specimen faces or of an edge. One method determines all twin indices directly from a stereographic construction; it has the advantage that all operations may be shown in relation to the crystal lattice, but adds the uncertainty inherent in constructions. The other method finds the twinning shear magnitude and direction (and thus the other twin indices) analytically in terms of trigonometric functions of the measured angles. Without adding inherent uncertainties, it presents the shear components in a form revealing their dependence on measurement precision. (auth)

2383

DOMAIN CONVERSION OF MULTIDOMAIN BARIUM-TITANATE SINGLE CRYSTALS. P. H. Fang, S. Marzullo, and W. S. Brower (National Bureau of Standards, Washington). Phys. Rev. 108, 242-3(1957) Oct. 15.

It is found that complete domain conversion of single crystal $BaTiO_3$ can be achieved by passing the crystal through the orthorhombic-tetragonal transition under an applied d-c field. By using this process either complete a or c domain crystals can be prepared. (auth)

2384

RELATION BETWEEN NEUTRON SCATTERING IN POLYCRYSTALS AND SPECIFIC HEAT. M. V. Kazarnovskii (Academy of Sciences, USSR). Soviet Phys. JETP 4, 600-2(1957) May.

The crystalline frequency spectrum entering into the cross section for inelastic coherent scattering of thermal neutrons in polycrystals is linked with the lattice specific heat at constant volume and can be determined from experimental values of the specific heat. However, such a procedure is subject to errors of considerable magnitude and are difficult to control. It is possible to do better with the characteristics of neutron scattering which depend on integrals over the frequency spectrum, such as the total cross section for inelastic scattering. This procedure is demonstrated in calculating the quantity σ_-, which for very cold neutrons coincides with the total coherent cross section. (M.H.R.)

Electrical Discharge

2385 AEC-tr-2730

ON THE INTERACTION OF A BEAM OF CHARGED PARTICLES WITH AN ELECTRON PLASMA. A. T. Akheizer and Ya. B. Fainberg. Translated from Doklady Akad. Nauk S.S.S.R. 69, 555-6(1949). 3p.

Equations are developed which describe the interaction of a plasma with an electron beam. (D.E.B.)

2386

ON THE OSCILLATIONS OF AN ELECTRON PLASMA IN A

MAGNETIC FIELD. A. G. Sitenko and K. N. Stepanov (Academy of Sciences, Ukrainian SSR). Soviet Phys. JETP 4, 512-20(1957) May.

The kinetic theory of the oscillations of an electron plasma in a constant magnetic field is examined. An investigation is made of plasma oscillations of frequencies which are integral multiples of the gyromagnetic frequency. The indices of refraction are determined for the ordinary, the extraordinary and the plasma waves which are propagated at an arbitrary angle θ with respect to the magnetic field. It is shown that at frequencies which are integral multiples of the gyromagnetic frequency the plasma wave is highly damped if $\theta < \pi/2$. If $\theta \approx \pi/2$ then the plasma waves corresponding to these frequencies cannot be propagated at all. The width of the "gaps" in the frequency spectrum of the plasma oscillations is determined. (auth)

2387

NOTE ON WAVES IN A HOMOGENEOUS MAGNETOACTIVE PLASMA. B. N. Gershman (Gorki State Univ.). Soviet Phys. JETP 4, 582-5(1957) May.

A quasi-hydrodynamic treatment of the relationship existing between different types of normal waves propagated in a homogeneous plasma situated in a magnetic field is explained. The results obtained by this and kinetic methods of investigation are compared. (M.H.R.)

Electrons

2388 AEC-tr-3084

THE ROLE OF THE ELECTRON CLOUD IN THE PHENOMENA OF RADIOACTIVITY. (Le Rôle du Cortège Electronique dans les Phénomènes de Radioactivité.) R. Daudel and M. Jean. Translated by Marcel I. Weinreich from Compt. rend 229, 354-6(1949). 5p.

2389

COMPTON EFFECT IN THE EXTENDED ELECTRON. V. S. Barashenkov. Soviet Phys. JETP 4, 599-600(1957) May.

The problems involved in the introduction of cutting-off form factors into the mathematical formalism of the present field theory, which results necessarily in the condition of the gauge invariance relations, are considered in the simple case of the Compton scattering. (M.H.R.)

2390

IONIZATIONAL SLOWING DOWN OF HIGH-ENERGY ELECTRON POSITRON PAIRS. V. B. Berestetskii and B. V. Geshkenbein. Soviet Phys. JETP 4, 609-10(1957) May.

The components of a high energy electron-positron pair of energy E separate with the small angle $\theta \sim mc^2/E$. The interference of the electron and positron fields at a small distance from the point of creation leads to a smaller ionization than that which would be caused by two electrons. Another derivation of the equations of the ionizational slowing down of a pair are given and the limitations of such a development are clarified. A method first shown by Landau is used. (M.H.R.)

2391

TRANSITION EFFECT BY FAST ELECTRONS. G. Breitling. Z. Physik 149, 180-98(1957). (In German)

Gases

2392 ATI-77863

CONTRIBUTIONS TO THE THEORY OF DETONATION. W. Doering and G. Burkhardt. Translated from a publication of Zentrale für Wissenschaftliches Berichtswesen, Berlin-Adlershof. Apr. 1944. 358p. (F-TS-1227-1A; GDAM-A9-T-46).

This translation prepared by Brown Univ.

The fundamental equations of gas dynamics are presented in their general form as well as in the forms pertaining to the most important special cases. The Hugoniot shock relations are given, and the shock wave equations are evaluated analytically and numerically for an ideal gas with a constant specific heat, temperature-dependent specific heat, and for air and for liquids and solids. (auth)

2393

PROPERTIES OF AN IONIZED GAS OF LOW DENSITY IN A MAGNETIC FIELD. III. S. Chandrasekhar, A. N. Kaufman, and K. M. Watson (Los Alamos Scientific Lab., N. Mex. and Univ. of California, Livermore). Annals of Physics 2, 435-70(1957) Nov.

Equations are derived which describe the hydrodynamic properties of an ionized gas in a strong magnetic field and in states close to an initial stationary state. The development is based on the Boltzmann equation in which the effects of collisions between the constituents of the gas are ignored. The theory is, therefore, applicable only for following the evolution of the gas for durations which are short compared to the thermalization time. The method of solution followed is essentially one of expansion in inverse powers of the strength of the impressed magnetic field; and in the first approximation the Boltzmann equation is reducible to a one-dimensional inhomogeneous wave equation which describes the motions of the particles along the magnetic field lines. (auth)

2394

THE SOLUTION OF INERT GAS ATOMS IN METALS. D. E. Rimmer and A. H. Cottrell (Atomic Energy Research Establishment, Harwell). Phil. Mag. (8) 2, 1345-53(1957) Nov.

Estimates are made of the energies of interstitial and substitutional solutions of inert gas atoms in a simple metal. The loss of cohesion round such an atom is taken into account by regarding the atom as occupying a vacancy in the metal. Most of the energy of solution, particularly for the larger atoms, originates from the closed-shell interactions, which are estimated from interaction potentials based on data for the inert gases and on Huntington's potential for copper ions. Argon, krypton, and xenon are expected to dissolve substitutionally in copper under all circumstances, even to the extent of forcing copper atoms off the lattice if no vacant sites are available. Neon should and helium may dissolve substitutionally when vacancies are available, but not otherwise. The strains round xenon and krypton atoms are so large that extra vacancies may be captured by these atoms to reduce the strain energy. The solubilities and diffusion of inert gas atoms in metals are briefly discussed in the light of these conclusions. (auth)

2395

MASS SPECTROGRAPHIC INVESTIGATION OF PHOTOIONIZATION IN GASES. Eberhardt Schönheit. Z. Physik 149, 153-79(1957). (In German)

Instruments

2396 CML-57-SR-M124-2

Chicago. Univ. Chicago Midway Labs.

HIGH-ALTITUDE SAMPLING TECHNIQUES. Progress Report. Walter Fagan. Aug. 1957. 12p. Contract AT(11-1)-508. $3.30(ph OTS); $2.40(mf OTS).

A stratospheric air sample collector for use in radiation monitoring was designed. The apparatus consists of a

balloon-borne air collector which will pump air into tubing surrounded by liquid nitrogen, thus condensing the air which is then collected in a closed container. A schematic sketch of a test apparatus is included. (C.H.)

2397 SCTM-195-57(51)
Sandia Corp., Albuquerque, N. Mex.
A CALIBRATED RASTER GENERATOR. George E. Ingram. Aug. 27, 1957. 7p. Contract AT-(29-1)-789. $1.80(ph OTS); $1.80(mf OTS).

A semiautomatic electromechanical device capable of generating accurately calibrated oscilloscope horizontal traces or raster is described. Inherent nonlinearities in scope deflection circuits create nonlinear traces on the screen and a fixed reference such as grid lines has little value when precision measurements are required. A raster therefore will produce an accurate continuous reference from which waveforms may be analyzed. (auth)

2398 SCTM-232-57(52)
Sandia Corp., Albuquerque, N. Mex.
TAPE DATA EDITOR. J. E. Liston. Sept. 10, 1957. 18p. Contract AT-(29-1)-789. $3.30(ph OTS); $2.40(mf OTS).

The Tape Data Editor is a transistorized d-c amplifier and level indicator that is used in connection with a galvanometer recorder. The unit, which contains its own transistor-regulated power supply, was designed to accept a 0- to ±3-volt, 300-ohm input and to deliver a 0- to ±5-volt output across a 50-ohm load. The unit also has provisions for obtaining two indications when a preset level has been exceeded. One indication is an indicator light; the other is a pulse that may be applied to a galvanometer. (auth)

2399 SCTM-290-57(52)
Sandia Corp., Albuquerque, N. Mex.
A MINIATURE VHF TELEMETERING TRANSMITTER FOR 28-VDC OPERATION. L. G. Synder. Oct. 29, 1957. 11p. Contract AT-(29-1)-789. $3.30(ph OTS); $2.40(mf OTS).

A miniature VHF telemetering transmitter for direct 28-volt DC operation is described. Specific electrical and mechanical characteristics are given. Environmental tests and results are described. (auth)

Isotopes

2400 IDO-16054
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
IRRADIATION OF THORIUM "W" SLUGS IN MTR A-PIECE POSITIONS. G. H. Hanson. Feb. 18, 1953. Decl. Oct. 23, 1957. 13p. Contract AT(10-1)-205. $3.30 (ph OTS); $2.40(mf OTS).

The recommendations (and supporting calculations) which were presented to the Program Committee in connection with two proposals concerning the irradiation of Th in the MTR are reported. Two columns of Hanford-type slugs can be irradiated in an A-piece for four 24-day cycles in those locations where the maximum unperturbed thermal flux is 2×10^{14} and the gamma flux is one watt per gram, providing the cooling-water velocity of 26 ft/sec is maintained. When those A-piece positions are used which are most removed from the active lattice (where the unperturbed thermal flux and gamma flux at the reactor midplane are 0.5×10^{14} and 0.2 watt per gram, respectively), with the above mentioned cooling-water velocity, a double column of thorium can be irradiated for any reasonable period as far as operating temperatures and thermal stresses are concerned. However, if it becomes desirable to irradiate these slugs for an indefinite period, other considerations (e.g., the optimum operating time for U^{233} production and radiation damage to the Th and Al cladding) will dictate the length of the irradiation period. (auth)

2401
THE PREPARATION AND HANDLING OF ARTIFICIAL RADIOELEMENTS. René Constant. Industrie chim. belge 22, 1151-60(1957). (In French)

Isotope Separation

2402 IGR-TN/CA-652
Gt. Brit. Capenhurst Works, Capenhurst, Ches., England.
THE EXCHANGE OF DEUTERIUM BETWEEN HYDROGEN CHLORIDE AND WATER. O. Pugh and V. Y. Labaton. Aug. 1957. 9p.

The exchange of deuterium between HCl and water was studied briefly, using the azeotropic system in a fractionating column. The isotope separation obtained was similar to that obtained by the distillation of water under similar conditions. It has been shown theoretically and practically that the azeotropic system is unfavorable for this chemical exchange. Distillation of the HCl–water azeotrope as a means of separating the isotopes of H_2 showed no advantage over the distillation of water; a separation factor of the order of 1.03 was measured. (auth)

2403
THE USE OF DIOCTYL PHOSPHORIC ACID EXTRACTION IN THE ISOLATION OF CARRIER-FREE ^{90}Y, ^{140}La, ^{144}Ce, ^{143}Pr, AND ^{144}Pr. D. F. Peppard, G. W. Mason, and S. W. Moline (Argonne National Lab., Lemont, Ill.). J. Inorg. and Nuclear Chem. 5, 141-6(1957).

Tracer-level Ce has been oxidized to the tetravalent state and shown to be preferentially extracted from a 10M HNO_3 aqueous phase into a 0.75M, or 0.30M, solution of di(2-ethyl hexyl) orthophosphoric acid in n-heptane. In this system the ratio of the K for Ce(IV) to that for Ce(III) is greater than 10^6, and the K for Ce(IV) is much greater than that for any trivalent lanthanide. This system has been utilized to purify Ce^{144} with respect to lanthanide contaminants, including its Pr^{144} daughter, and to prepare a highly-purified gross sample of natural Ce for neutron bombardment in the preparation of Pr^{143}. It has been used also in the isolation of Pr^{143} and Pr^{144} products for tracer studies and for half-life determinations. A decontamination factor, with respect to the parent Ce^{144}, greater than 10^7 was obtained for a Pr^{144} sample isolated and prepared for counting in a period of less than 10 min. Other di(2-ethyl hexyl)-orthophosphoric acid systems employing dilute HCl or HNO_3 as the opposing phase have been used for separating Y^{90} from its Sr^{90} parent and for separating La^{140} from its Ba^{140} parent and from contaminant Sr^{90}–Y^{90}. Decontamination factors greater than 10^7 have been obtained in both separations, the total processing times being less than 15 min. The following new half-life values have been obtained: Y^{90}, 63.97 ± 0.1 hr; La^{140}, 40.27 ± 0.05 hr; Pr^{143}, 13.59 ± 0.04 day; and Pr^{144}, 17.27 ± 0.04 min. (auth)

Mass Spectrography

2404
MASS SPECTROMETER IONIZATION CHAMBER. James A. Rickard (Humble Oil & Refining Co., Houston, Texas). Rev. Sci. Instr. 28, 967-8(1957) Nov.

Conventional ion sources for sector-field detection direction focusing mass spectrometers have generally been patterned after those of Nier. In 1954 Schaeffer described an ion source in which the iron pole pieces of the electron beam alignment magnet were integral with the ionization chamber. Among the advantages cited were ease in me-

chanical alignment, better homogeneity of the magnetic field, and a greatly strengthened magnetic field. This note describes two models of an ion source in which both the magnets on appropriate pole pieces are integral with the ionization chamber. The ion source is a part of a 40° 9 in. focusing mass spectrometer used for isotopic ratio determinations. (A.C.)

Mathematics

2405 57-GL-92
General Electric Co. General Engineering Lab., Schenectady, N. Y.
RELIEF OF THERMAL STRESSES THROUGH CREEP. H. Poritsky and F. A. Fend. Apr. 17, 1957. 34p.

Equations are developed for analyzing the effects of thermal creep on stress distributions. In formulating these elasto-plastic equations, the tensile test stress-strain creep data are extended, to compound stresses by means of the Mises-Hencky hypothesis. The various equations are manipulated to yield a numerical procedure by means of which the stress and strain components are computed successively at the end of various time intervals. In these calculations it is assumed that the initial creep rates remain constant during each time interval. The resulting equations are applied to the axially symmetric problem of relief of thermal stresses in an infinitely long cylinder which is quickly heated to a parabolic temperature, and maintained at that temperature. End effects are neglected. The calculation is reduced to repeated solutions of a certain second order ordinary differential equation. Curves are plotted showing the gradual relief of the stresses caused by the creep. The methods developed are illustrative of a procedure which may be followed for other stress creep problems. (auth)

2406 KAPL-M-EVD-1
Knolls Atomic Power Lab., Schenectady, N. Y.
A COMPARISON OF WOXX, WOX-2 AND WOX-3, KAPL 3-GROUP MACROSCOPIC CROSS SECTION CODES FOR THE IBM 704. Elizabeth L. VanDriesen. Aug. 16, 1957. 27p. Contract W-31-109-eng-52. $4.80(ph OTS); $2.70(mf OTS).

The KAPL Machine Programs WOXX, WOX-2 and WOX-3, designed for the calculation of 3 Group Macroscopic Cross Sections on the IBM 704, are discussed and compared. The general equations are those prescribed by R. W. Deutsch, and enlarged on by E. L. Wachspress. Fitted functions for microscopic fuel and Xe cross sections are prescribed by L. S. Bohl. Complete input and output with operating instructions are presented. (auth)

2407 KAPL-M-SMS-76
Knolls Atomic Power Lab., Schenectady, N. Y.
NOMACS–AN IBM-704 CODE FOR DESIGN EVALUATION OF A NUCLEAR POWER PLANT. F. J. Scheib. [Aug. 20, 1957]. 26p. Contract W-31-109-Eng-52. $6.30(ph OTS); $3.00(mf OTS).

The NOMACS code will analyze the transients of a nuclear power plant on the IBM-704 digital computer. Its basic representation consists of one reactor, two main coolant loops, two steam generators, and one steam system with two turbines. Its unique capabilities for transient analysis include both symmetrical and non-symmetrical loop operation, constant and variable loop flow, natural temperature coefficient and reactor protective system control, manual and automatic initiation of control, and steady-state and transient initial conditions. Its normal driving functions are main turbine throttle position, main coolant flow rate in either or both loops, reactor control rod reactivity, and reactor power. It has provision for automatic calculation of initial conditions, saturated steam-water property tables, varied and unlimited output data, and operation of various portions at different time intervals to minimize machine time. Types of analyses already completed are normal maneuvers, cold water accidents, pump-switching, and manual scrams using a variety of operating parameters. The current output data include reactor power and reactivity; system temperatures, pressures, and flow rates; system average temperature; and turbine throttle position. The IBM-704 equipment required includes an 8000-word core and one tape unit. An approximate ratio of machine-to-problem time is 80 to 1. (auth)

2408 LA-2139
Los Alamos Scientific Lab., N. Mex.
THE PARTICLE-IN-CELL METHOD FOR HYDRODYNAMIC CALCULATIONS. Martha W. Evans and Francis H. Harlow. June 1957. Appendix II by Eleazer Bromberg. 76p. Contract W-7405-eng-36. $2.00(OTS).

This report supersedes LAMS-1956 and LAMS-2082.

A method is presented for solving hydrodynamic problems involving large distortions and compressions of the fluid in several space dimensions. The calculation procedure introduces finite difference approximations to the differential equations; the solution in practice is carried out by means of high-speed electronic computers. The characteristics of the method are discussed and these are illustrated by presenting results of representative calculations. (auth)

2409 LAMS-2082
Los Alamos Scientific Lab., N. Mex.
THE PARTICLE-IN-CELL METHOD FOR TWO-DIMENSIONAL HYDRODYNAMIC PROBLEMS. Francis H. Harlow, Martha W. Evans, and David E. Harris, Jr. Aug. 29, 1956. 65p. Contract W-7405-eng-36. $10.80(ph OTS); $3.90(mf OTS).

The machine calculation method for two- or higher-dimensional hydrodynamic problems, in which large slips or distortions of the materials are expected, was extended and tested further. (M.H.R.)

2410 NYO-8502
Ford Instrument Co., New York.
APPLICATION OF DIGITAL TECHNIQUES TO REACTOR CONTROL SYSTEMS. Quarterly Report No. 3 [for] May 1 to July 31, 1957. Oct. 17, 1957. 49p. Contract AT(30-1)-1969. $7.80(ph OTS); $3.30(mf OTS).

Three specific applications of digital techniques to reactor controls have been studied. A system to utilize digital techniques for startup control is discussed with emphasis on system approach, output display, size, weight, cost and information smoothing techniques. A breadboard design to establish feasibility of a rod position indicator system is described. This system utilizes an electromagnetic delay line principle. Two pressure indicating schemes are described. (For preceding period see NYO-8501). (auth)

2411 ORNL-2290
Oak Ridge National Lab., Tenn.
ORACLE PHOTOGRAPHIC CURVE PLOTTER AND DIGITAL-OUTPUT DEVICE. R. J. Klein and C. H. Schalbe. Dec. 12, 1957. 27p. Contract W-7405-eng-26. $1.00(OTS).

The curve plotter serves as both an output device and as a monitor. As an output device, it can be used to obtain permanent records, in the form of photographs, of curves, data, or stored information all tabulated, labeled, and identified. Photographs are taken automatically at a rate determined by the amount of information displayed and by the film-advance mechanism. A maximum of 200 photographs can be made before the camera has to be reloaded. The monitor or slave scope can be used as a rapid visual

check on problem progress, parameter selection, and validity of computations. (auth)

2412 UCRL-4940
California. Univ., Livermore. Radiation Lab.
THE NUMERICAL SOLUTION OF THE TIME-DEPENDENT TRANSPORT EQUATION IN FINITE CYLINDRICAL GEOMETRY. Joseph Fleck. Aug. 26, 1957. 27p. Contract W-7405-eng-48. $4.80(ph OTS); $2.70(mf OTS).

A system of finite difference equations is derived from the time-dependent transport equation for solving problems in finite right cylindrical geometry. The equations are likewise applicable to any azimuthally symmetric geometry. The method employed is a generalization of the spherical S_n technique. An alternative set of equations is derived for the purpose of avoiding negative fluxes near the origin of the system. A rough scheme is presented for coding the equations for calculation on an IBM 704. (auth)

Measuring Instruments and Techniques

2413 AECU-3586
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]
NUCLEAR INSTRUMENTATION SYSTEM; SYSTEM DESCRIPTION NO. 15. N. E. Wilson. May 12, 1956. 12p. $3.30(ph OTS); $2.40(mf OTS).

Modifications are described in the nuclear instrumentation system of the Shippingport Pressurized Water Reactor designed to monitor neutron flux level from source to 150% of reactor designed full power output, to compute the rate of change of the neutron flux level for indication and control, and to provide level and rate of change of level signals for reactor shutdown to prevent reactor damage. (C.H.)

2414 TRDC/P-55
United Kingdom Atomic Energy Authority. Industrial Group H. Q., Risley, Lancs, England.
PROPOSED EQUIPMENT FOR NEUTRON FLUX MEASUREMENT IN THE CALDER WORKS THERMAL REACTORS. R. J. Cox and G. V. Hough. Oct. 4, 1954. 9p.

The six types of equipment proposed are linear power level equipment, backed-off or drift power level equipment, shut-down equipment, logarithmic d-c amplifier and period meter equipment, logarithmic pulse counting equipment, and equipment for loading experiments. These allow neutron flux measurements to be made over the entire flux range for subcritical to full-power conditions. Each type of equipment serves a different purpose, but at any power level more than one type of equipment is indicating the power level. (M.H.R.)

2415 UCLA-413
California. Univ., Los Angeles. Atomic Energy Project.
A TIME OF ARRIVAL INDICATOR FOR RADIOACTIVE FALLOUT. Ross W. Farmer and Oscar Reiner, Jr. Nov. 22, 1957. 16p. Contract AT-(04-1)-GEN-12. $0.50(OTS).

This report describes an instrument designed to record the time of arrival of radioactive fall-out material. The unit incorporates its own power supply, it can be operated unattended for a period of about four weeks, is rugged enough to tolerate the treatment normally associated with field operation and it is comparatively inexpensive. The unit responds to the absolute level of radiation and, in practice, has been used to detect a radiation level of 2 milliroentgens per hour. (auth)

2416 UCRL-8000
California. Univ., Berkeley. Radiation Lab.
MILLIMICROSECOND COINCIDENCE CIRCUIT FOR HIGH SPEED COUNTING. William A. Wenzel. Oct. 2, 1957. 14p. Contract W-7405-eng-48. $0.50(OTS).

A coincidence circuit of high resolution, which performs reliably under high counting rates is described. The basic circuit, consisting of a pentode limiter feeding a simple Rossi-type diode coincidence circuit, is readily adaptable to a variety of uses. (auth)

2417 USNRDL-TR-156
Naval Radiological Defense Lab., San Francisco.
A PROBE TYPE HIGH RANGE GAMMA RADIAC. G. T. Kiyoi, K. Miller, K. F. Sinclair, R. H. Sorenson, H. R. Wasson, and D. H. Williams. Apr. 1, 1957. 50p.

An ionization chamber instrument was designed to measure high range gamma fields primarily in the vicinity of nuclear reactors used for propulsion of vessels and aircraft. Unusual features of the device include the probe extensions consisting of a rigid section and a flex section, permitting location of the detector up to 33 inches from the instrument housing, and the all transistor power supplies. The switch selected ranges available are 0 to 5 r/hr, 0 to 50 r/hr and 0 to 500 r/hr. Over-all accuracy of the device, including detector energy and directional dependence, is better than ±20% over the energy range from 0.08 Mev to 2 Mev when referred to the true value of radiation intensity. (auth)

2418 WAPD-EM-177(Rev.)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
INVESTIGATION OF PULSE CHANNEL OPERATION WITH A FISSION COUNTER IN HIGH GAMMA RADIATION. J. Kostalos. Oct. 18, 1957. 13p. $3.30(ph OTS); $2.40(mf OTS).

Tests were conducted to determine the performance of a fission counter detector and the associated pulse amplifier chain when the counter is subjected to an intense gamma flux. The fission counter filling gas was 99% argon + 1% nitrogen at 1 atm. pressure instead of the original filling of 2 atm. of nitrogen. The results of the tests indicate that a 50% reduction in over-all gain and a minor change in the preamp input circuit were necessary, and in the presence of about 10^5 r/hr gamma flux, the sensitivity of the system is reduced by 20%. This sensitivity is defined as the number of neutron counts for a given flux with the background counting rate set at 10 cps. (auth)

2419 WCRT-TM-56-88
Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.
FIRST MEETING OF THE ANP ADVISORY COMMITTEE FOR NUCLEAR MEASUREMENTS AND STANDARDS. S. A. Szawlewicz. July 26, 1956. 15p.

The attendance list, the agenda, the minutes and the recommendations of this committee are given. (M.H.R.)

2420 WCRT-TM-57-5
Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.
THIRD MEETING OF THE ANP ADVISORY COMMITTEE FOR NUCLEAR MEASUREMENTS AND STANDARDS. S. A. Szawlewicz, K. Wolfsberg, and W. R. Burrus. Jan. 29, 1957. 23p.

The types of nuclear measurements needed for predicting radiation effects are summarized. Papers are included on standard techniques for nuclear environmental testing, radiation effects in lubricating oils, engineering applications of radiation damage data, the industry sponsored nuclear standards board, measurements with foil threshold detectors, and a nitrous oxide dosimeter. (M.H.R.)

2421
GAMMA ABSORPTIOMETER FOR SOLUTIONS OF HEAVY

METAL SALTS. Donald H. Thurnau (E. I. du Pont de Nemours & Co., Inc., Aiken, S. C.). Anal. Chem. 29, 1772-4(1957) Dec.

A simple, rugged gamma absorptiometer has been constructed for analysis of uranium solutions by nontechnical operators. Am^{241} is source of the γ rays. Use of high sensitivity scintillation detector minimizes radiation hazard. Standard deviations of 0.05% are obtained in concentration range of 50 to 100 grams per liter. (auth)

2422

FAST NEUTRON SPECTROMETRY. Denis O'Connor. (Inst. of Nuclear Research, Warsaw). Nucleonika 2, No. 1, 1-8(1957). (In Polish)

Investigations were made of fast neutron spectroscopy in the 1 to 12 Mev energy range, and descriptions are given of the design and performance of the apparatus used. (R.V.J.)

2423

SEMIAUTOMATIC GAP COUNTER FOR NUCLEAR EMULSIONS. M. V. Klein (Cornell Univ., Ithaca, N. Y.). Rev. Sci. Instr. 28, 964-5(1957) Nov.

The gap counting technique has proved valuable for measuring the ionization tracks of fundamental particles in nuclear emulsions. This note describes a semiautomatic device which simultaneously records the total number of gaps and the total length of gap of the individual gaps. (A.C.)

2424

INVESTIGATION OF HIGH ENERGY ELECTRON SHOWERS BY THE "EMULSION CHAMBER" TECHNIQUE. I. M. Gramenitskii (Academy of Sciences, USSR). Soviet Phys. JETP 4, 586-8(1957) May.

The development of electron showers of high energy ($E = 10^{12}$ev) at small depths (2 to 3τ units) was studied in an emulsion chamber of type previously suggested. The results obtained are compared with cascade theory. (M.H.R.)

Mesons

2425 UCRL-8005

California. Univ., Berkeley. Radiation Lab.

ANGULAR CORRELATIONS IN THE PRODUCTION AND DECAY OF SPIN-$\frac{3}{2}$ HYPERONS. Richard Spitzer and Henry P. Stapp. Oct. 4, 1957. 5p. Contract W-7405-eng-48. $0.50(OTS).

Simple relationships between the angular distribution in the decay of a spin-$\frac{3}{2}$ hyperon and the directions defined by the production mechanism are obtained for the case in which only final S and P waves contribute to the production process. (auth)

2426 AEC-tr-3027

ELASTIC SCATTERING OF 307 MEV NEGATIVE PIONS BY HYDROGEN. S. M. Korenchenko and V. G. Zinov. Translated from a publication of the Joint Inst. for Nuclear Research, U.S.S.R. Mar. 1957. 9p.

The angular distribution of π^--mesons in the process $\pi^- + p \rightarrow \pi^- + p$ was investigated with a scintillation counter method. The pion beam was incident on liquid hydrogen and scattered mesons were detected simultaneously at two angles by telescopes consisting of two liquid scintillation counters. (M.H.R.)

2427

PARITY MIXTURES AND DECAY PROCESSES. H. S. Green and C. A. Hurst (Univ. of Adelaide, S. Australia). Nuclear Phys. 4, 589-98(1957) Oct.

This paper examines the hypothesis that the μ meson as well as the Λ and Ξ hyperons are parity mixtures and shows that the facts commonly attributed to parity nonconservation are explained in a unified way by this hypothesis, provided physical theory is invariant with respect to parity conjugation. A simple theory of parity mixtures is developed in both parity conserving and parity destroying forms, to distinguish those experimental consequences which are incompatible with parity conservation. It is pointed out that the experiments on $\pi-\mu-e$ decay do not establish a failure of parity conservation as claimed, and that there is at present no evidence which conclusively verifies the longitudinal neutrino hypothesis. The latter, however, may be regarded as an instance of a more general hypothesis that states of "left-handed" parity do not occur in nature, in favor of which prima facie evidence already exists. The facts concerning the decay modes of the heavy mesons can also be explained readily on this basis. (auth)

2428

COULOMB CORRECTIONS TO τ-MESON DECAY. Earle L. Lomon (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 108, 458-60(1957) Oct. 15.

The effect of the Coulomb interaction on the energy and angular distribution of the final-state pions in τ-meson decay is calculated by perturbation theory. The result indicates a shift of the order of magnitude of 3% from large to small energies and angles. The result differs in some quantitative aspects from those previously derived by treating some or all of the pions classically. In particular the energy dependence of the correction disappears at low energies. (auth)

2429

ASSOCIATED PHOTOPRODUCTION OF K AND Λ PARTICLES AND POSSIBLE "UP-DOWN" ASYMMETRY IN THE Λ DECAY. J. J. Sakurai (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 108, 491-3(1957) Oct. 15.

The possibility of detecting parity nonconservation in the decay of Λ particles produced by the reaction $\gamma + p \rightarrow \Lambda^\circ + K^+$ is discussed. The photoproduction matrix is studied from a phenomenological point of view, and the conditions essential for the detection of an "up-down" asymmetry are examined. (auth)

2430

PHOTOPRODUCTION OF K MESONS IN HYDROGEN. A. Silverman, R. R. Wilson, and W. M. Woodward (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 108, 501-2(1957) Oct. 15.

2431

INTERACTION BETWEEN NEGATIVE PIONS AND HELIUM NUCLEI AT 330 Mev ENERGY. M. S. Kozodaev, R. M. Sulaev, A. I. Filippov, and Iu. A. Shcherbakov. Soviet Phys. JETP 4, 580-2(1957) May.

The results of an analysis of 97 events of interaction obtained from an examination of approximately 13,000 photographs are given. The cross sections obtained in the various processes are included. (M.H.R.)

2432

DISPERSION RELATIONS FOR PIONS SCATTERED BY DEUTERONS. B. L. Ioffe, I. Ia. Pomeranchuk, and A. P. Rudik. Soviet Phys. JETP 4, 588-9(1957) May.

The dispersion relations obtained for the scattering of pions by deuterons contain, in addition to the constant, certain effective values of the potential interaction energy of two nucleons in different states, and these values affect substantially the value of the singularity term for deuterons, polarized perpendicularly to the incident beams. (M.H.R.)

2433

ON A CERTAIN REGULARITY OF DECAYING UNSTABLE PARTICLES. P. S. Isaev and V. S. Murzin (Moscow State

Univ.). Soviet Phys. JETP 4, 591-2(1957) May.

Values of the decay energy Q, experimentally observed or computed from the known masses of the particles and from decay schemes, are given (in Mev) for μ, π, K, Λ, Σ, and Ξ. The values of the quantity $n = Q/q$ where $q = 35.5$ Mev $= 69.5\ m_e$ are close to integers. An exception is noted only in cases when the decay leads only to stable particles (for example, neutron or π^0). (M.H.R.)

Meteorology

2434 BNL-3323

Brookhaven National Lab., Upton, N. Y.

AIR SAMPLING IN RELATION TO THE METEOROLOGICAL PROGRAM AT BROOKHAVEN NATIONAL LABORATORY. Robert M. Brown. [1957]. 19p. $3.30(ph OTS); $2.40(mf OTS).

Equipment and procedures are described which are used for the measurement of basic meteorological elements and for atmospheric sampling. Two meteorological towers are equipped with instruments for sensing wind direction, wind speed, and temperature at several levels in the vertical to 410 feet and across a horizontal span of 900 ft. Data from the instruments on the tower are transmitted by underground cables to a recording panel located in a building. One tower is equipped with a smoke generating system to produce an oil fog which can be observed visually, photographed, and measured. A description is included of air sampling equipment. (C.H.)

2435 AEC-tr-3091

THE YEARLY COURSE OF OVERCAST IN WORLD-WIDE PRESENTATION. (Der Jahresgand der Bewölkung in Weltweiter Darstellung.) E. Ekhart. Translated by M. I. Weinreich from Meteorol. Abhandl. 2, 39-52(1955). 17p.

Stimulated by the successful attempt of an analysis of the annual trend of the overcast [or cloud covering] in the Alps, we have extended such a study to the entire globe. The period vectors representing the first and second term of the Fourier series were rendered on the earth maps in the same fashion as the air of water movements. The only difference is that we were still lacking appropriate short expressions for the envelopes of the directional elements which correspond to the flow lines, and that we still do not have the isolines of the absolute amount of the yearly or semi-annual period vector of the cloud cover. The maps in this study convey a well-integrated and synoptic picture of the heretofore disconnected description of the various types of the annual periodicity in the change of the overcast and its more or less continuous transitions. (auth)

Microwaves

2436 UNM-TR-EE-6

New Mexico. Univ., Albuquerque. Engineering Experiment Station.

RESOLUTION OF VERTICAL INCIDENCE RADAR RETURN INTO RANDOM AND SPECULAR COMPONENTS. R. K. Moore. July 1957. 29p. For Sandia Corp. Contract [AT-(29-1)-789]. $4.80(ph OTS); $2.70(mf OTS).

A rough method is presented for resolving radar signals returned from the ground at near-vertical incidence into specular and random components. This preliminary investigation was for scalar waves rather than vector waves. The initial development was carried out for a perfectly conducting ground. (M.H.R.)

Molecular Properties

2437

THE CRYSTALLINE STRUCTURE OF HYDROGEN AND DEUTERIUM V. S. Kogan, B. G. Lazarev, and R. F. Bulatova (Academy of Sciences, Ukrainian SSR). Soviet Phys. JETP 4, 593-4(1957) May.

The structure of deuterium was determined to be tetragonal, with a ratio of axes $c/a = 0.94$ and a parameter $a = 5.4$A. Since hydrogen previously was found to have a hexagonal close-packed lattice with parameter $a = 3.75$A, this previous work was checked and errors are discussed. (M.H.R.)

2438

ON MOLECULAR NEUTRONOSCOPY. V. I. Gol'danskii (Academy of Sciences, USSR). Soviet Phys. JETP 4, 604-6(1957) May.

It is proposed to subject molecules under investigation to bombardment by short pulses of monoenergetic neutrons ($E_0 = 1$ to 10 ev) and to determine the binding energy of the molecules, the probability of various molecular conversions induced by the neutrons, and other characteristics from the type of time-of-flight spectrum and of the angular distribution of the scattered neutrons. The possibilities, advantages, and disadvantages of this method are discussed. (M.H.R.)

Neutrons

2439 CF-57-11-42

Oak Ridge National Lab., Tenn.

THE EFFECT OF VARIATIONS IN THE FISSION NEUTRON SPECTRUM AT HIGH ENERGIES ON THE AGE OF FISSION NEUTRONS IN WATER. H. Goldstein. Nov. 15, 1957. 12p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

2440

SCATTERING OF FAST NEUTRONS BY A NUCLEAR COULOMB FIELD. Iu. A. Aleksandrov and I. I. Bondarenko. Soviet Phys. JETP 4, 612-14(1957) May.

The angular distribution of fast neutrons emerging from a reactor and scattered by Pb and Cu was studied and preliminary data is given. It is suggested that, in addition to the intrinsic electric dipole moment, the neutron may exhibit (in a strong Coulomb field) an electric moment caused by the deformation of the meson shell. Estimates indicate that if the neutron exhibits this "polarizability" $\alpha \sim r^3$ (where r is the nucleon dimension), the additional contribution to the cross section of the scattering of neutrons by heavy nuclei becomes noticeable. More careful experiments are needed for its detection. (M.H.R.)

Nuclear Physics

2441 AECU-3580

Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science.

ANNUAL PROGRESS REPORT [COVERING] RESEARCHES DURING THE PERIOD JUNE 1, 1956 TO MAY 31, 1957. Report No. 45. 230p. Contracts AT(30-1)-905 and Nonr-1841(16). $33.30(ph OTS); $9.60(mf OTS).

Results of solvent extraction studies on Au, Ga, Nb, and Ta are given. Data on the dependence of B_A, ϵ_A and S_A on A and on nucleon shells in beta decay are summarized. Rates of hydrolysis of benzyl and benzhydryl halides and methyl iodide in H_2O and D_2O are tabulated. Values for the solvolysis of triphenylmethyl fluoride, the decarboxylation

rates of β-keto acids, and the decomposition of single chlorosulfites are included. Experiments were conducted to examine the velocity spectrum of cosmic ray μ mesons at sea level, the incidence of air showers and their direction of arrival at sites in Bolivia and India, short period fluctuations in cosmic-ray intensity, the μ-meson component of large air showers, polarization of cosmic-ray μ mesons, and other related measurements. Photographic emulsion research continued on the dynamics of K^+ scattering and on a search for the Pais-Piccioni effects. The linear accelerator work centered about a study of γ-ray induced neutron spectra of Bi, Pb, Au, and Ta. The Rockefeller Van de Graaff Generator work was concerned with the measurement of g-factors of low-lying excited states of Sm, Nd, and Gd. Nuclear energy level studies using the ONR Van de Graaff Generator were concentrated largely on the nuclei between mass numbers 40 and 70. Efforts were directed toward a determination of level order and, where possible, of spins and parities of states. A number of angular distribution studies for deuterium stripping reactions were carried out. Research with the M.I.T. cyclotron involved a continuation of the angular distribution studies of elastically scattered 7.5-Mev protons, the measurement of polarization of such elastically scattered protons; 30-Mev α particle scattering, α particle and deuteron induced reactions and the development of apparatus for time-of-flight neutron energy measurements. (For preceding period see AECU-3377.) (M.H.R.)

2442 BNL-443

Brookhaven National Lab., Upton, N. Y.

ELEMENTARY PARTICLES AND WEAK INTERACTIONS. T. D. Lee and C. N. Yang. Oct. 1957. 64p. $2.00(GPO).

Some general patterns of interactions between various elementary particles are reviewed and some general questions concerning the symmetry properties of these particles are studied. Topics are included on the $\theta-\tau$ puzzle, experimental limits on the validity of parity conservation, some general discussions on the consequences due to possible non-invariance under P, C, and T, various possible experimental tests on invariance under P, C, and T, a two-component theory of the neutrino, a possible law of conservation of leptons and the universal Fermi interactions, and time reversal invariance and Mach's principle. (M.H.R.)

2443 CU-161

Columbia Univ., New York. Nuclear Physics Lab.

PROGRESS REPORT FOR APRIL, MAY, JUNE 1957, TO THE UNITED STATES ATOMIC ENERGY COMMISSION. Dept. of Physics. 32p. Contract AT-30-1-GEN-72. $4.80 (ph OTS); $2.70(mf OTS).

An analysis of the present status of low energy (n,p) scattering data was made to determine what future measurements would be most productive and the conclusions reached are given. The Columbia spectrometer was used to measure the transmission of the following samples at various neutron wavelengths: two samples of Nd, 11 samples of borosilicate glass designated as aliquots of the material reserved as a secondary neutron standard by the Corning Glass Co., the plates and various components of the B^{10} and U^{235} parallel plate ionization chambers which will be used to determine the absolute fission cross sections of U^{235}, and liquid Bi for the neutron-electron interaction experiment. Details of these measurements are given. A new system was designed which will record spectrometer data directly on Remington Rand punch cards. The total cross section of Nd was measured between 0.065 and 2.50 ev in order to resolve a discrepancy in BNL-325. Preliminary results with the Mileikowsky magnet show that the magnetic field fall-off parameter n has a value at maximum field of 0.6 ± 0.1. One run was made with the BNL 60" cyclotron to check the calculated counter solid angle. It varied simply as $1/\sin\theta$ as predicted. No conclusive evidence for an excited state around 7.3 Mev in O^{15} was found. Results of the work on the γ-emitting states in O^{16} below 12 Mev are summarized. The 2000 channel velocity spectrometer analyzer was run with a simulated velocity selector data input. (For preceding period see CU-158.) (M.H.R.)

2444 UCRL-3929

California. Univ., Berkeley. Radiation Lab.

ELECTROMAGNETIC STRUCTURE OF THE NUCLEON IN LOCAL-FIELD THEORY. Geoffrey F. Chew, Robert Karplus, Stephen Gasiorowicz, and Fredrik Zachariasen. Sept. 1957. 35p. Contract W-7405-eng-48. $1.00(OTS).

In analogy to the dispersion-relation method for scattering, the description of nucleon electromagnetic structure by local-field theory is discussed in terms of mass-spectral representations for the form factors. The existence of such representations is made plausible although not proved, and it is shown that the spectral distribution functions are related to scattering amplitudes on the mass shell but sometimes in a nonphysical region. It is argued that the main contributor to the magnetic moment structure in the spectral distribution must be the two-pion state, and an attempt is made to evaluate this contribution in terms of the known behavior of pion-nucleon scattering. A semiquantitative calculation yields results in reasonable agreement with experiment. It is emphasized that since in a local theory the charge-form factor will have a complicated behavior for very large momentum transfer, the large observed charge radius of the proton does not imply the dominance of the two-pion state in the charge structure. Thus it is not impossible that higher mass configurations supply the isotopic scalar charge needed to explain the small neutron-electron interaction. (auth)

2445

DEFINITION OF RELATIVE INTENSITY LINES IN Ta^{182} γ SPECTRA. O. I. Sumbaev (Mendeleev All-Union Research Inst. of Metrology). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 21, 987-9(1957) July. (In Russian)

2446

JOINT STUDIES ON NUCLEAR RESEARCH. Cestmir Simane. Jaderná Energie 2, 346-7(1956). (In Czech)

2447

PHYSICS OF FISSION. SUPPLEMENT NO. 1 TO SOVIET JOURNAL OF ATOMIC ENERGY. S. M. Popova, ed. New York, Consultants Bureau, Inc., 1957. 140p. $30.00.

Papers presented at the Conference on the Physics of Fission held in January, 1956, at the Institute of Atomic Energy, Academy of Science, USSR are given. Papers are included on a review of the theory of nuclear fission, cross section for fission induced by fast neutrons, mass and charge distribution of fission products, the theory of fission of heavy nuclei close to threshold, anisotropy in fission processes, neutron fission, certain features of nuclear fission at low and high excitation energies, cross section for fission of U by high-energy protons and an analysis of the light charged particles characteristic of fission, determination of the threshold for emissive fission using thick-layered photographic emulsions, spontaneous fission in heavy nuclei and photofission. (M.H.R.)

2448

ELECTRIC DIPOLE MOMENT ASSOCIATED WITH OCTUPOLE VIBRATIONS OF A SPHEROIDAL NUCLEUS. Aage Bohr and Ben R. Mottelson (Univ. of Copenhagen and CERN, Copenhagen, Denmark). Nuclear Phys. 4, 529-31 (1957) Oct.

The electric dipole transition probability associated with collective odd parity transitions is estimated on the basis of the polarization induced by the electric field of the nuclear deformation. The available experimental data are discussed in an attempt to obtain information on the nuclear octupole distortion. (auth)

2449

REPULSIVE CORE AND NUCLEAR SHELL THEORY. M. Bauer and M. Moshinsky. Nuclear Phys. 4, 615-24 (1957) Oct.

The effect on nuclear shell theory of an interaction potential between nucleons containing a repulsive core is discussed. It is shown that a repulsive hard core gives rise to the same interaction energy as a delta function potential of strength $4\pi(\hbar^2 a/m)$, where a is the range of the core and m the mass of the nucleon. The interaction energies for Yukawa potentials with and without repulsive cores are compared. (auth)

2450

LONG LIFETIME OF POSITRONIUM IN LIQUID HELIUM. Richard A. Ferrell (Naval Ordnance Lab., Silver Spring, Md. and Univ. of Maryland, College Park). Phys. Rev. 108, 167-8(1957) Oct. 15.

The long orthopositronium lifetime observed by Paul and Graham and Wackerle and Stump in liquid helium is evidence of a pickoff annihilation rate smaller by more than one order of magnitude than the rate to be expected on the basis of the average electron density. This discrepancy is removed by taking into account the repulsive positronium-helium exchange force already derived in previous work. By repelling the helium atoms and creating a cavity, or bubble, in the liquid, a positronium atom is able to avoid contact with the liquid and thereby greatly increase its lifetime. The small pickoff rate observed is attributed to the saturated vapor in the bubble. The repulsive exchange force further decreases this rate, and good agreement is obtained with experiment. It is predicted that increasing the temperature one degree Kelvin, from the boiling point to the critical point, will decrease the lifetime by a factor of three. Positron lifetime measurements in helium gas at liquid-nitrogen temperature and 0–100 atmospheres pressure would also provide a check on the theory. (auth)

2451

OXYGEN-16 BY THE METHOD OF GENERATOR COORDINATES. James J. Griffin (Princeton Univ., N. J. and Inst. for Theoretical Physics, Copenhagen, Denmark). Phys. Rev. 108, 328-35(1957) Oct. 15.

Dilatational and collective quadrupole excitations of the nucleus O^{16} are treated by the method of generator coordinates described in the preceding paper. In this method, one starts from assumed two-body forces and calculates the stiffness, inertia, and frequency of the collective motion. Numerical results are presented for these quantities. Experimental data relative to collective 0+ and 2+ states in O^{16} are summarized, and other theoretical treatments of this problem are discussed. It is noted that collective models all imply too large a matrix element for the decay of the 6.06-Mev (0+) state. One concludes that this state is not primarily a dilatational excitation. Similar considerations apply to the 6.91-Mev (2+) state. (auth)

2452

ANGULAR DISTRIBUTION OF N^{13} FROM N^{14} ON Mg^{25} M. L. Halbert and A. Zucker (Oak Ridge National Lab., Tenn.). Phys. Rev. 108, 336-41(1957) Oct. 15.

The angular distribution of N^{13} from the neutron transfer reaction $Mg^{25}(N^{14},N^{13})Mg^{26}$ was measured at an incident nitrogen energy of 27.9 Mev. N^{13} was caught on aluminum foils placed at various angles around the thin Mg^{25} target. The foils were counted after bombardment and N^{13} was identified by its 10-min half-life. The angular distribution was found to have a maximum at ≈65 deg in the center-of-mass system, to fall off sharply at forward angles, and to decrease more slowly at angles larger than 65 deg. The energy spectrum of N^{13} was measured at three angles around 65 deg (cm). It was found that the residual Mg^{26} is left in excited states and that the larger the angle the higher the states in which Mg^{26} is likely to be left. For the transfers leaving Mg^{26} in the ground state, a classical estimate of the distance, D, of closest approach was made. Expressing the result as $D = d_0 (A_1^{1/3} + A_2^{1/3})$, $D_0 = 1.9 \times 10^{-13}$ cm at the peak of the angular distribution. Thus, most of these transfers occur when the nuclei are not touching in the usual sense. (auth)

2453

CHARGE DENSITY IN THE DEUTERON. Jeremy Bernstein (Harvard Univ., Cambridge, Mass.). Phys. Rev. 108, 349-52(1957) Oct. 15.

The phenomenological theory of the deuteron charge distribution is discussed. Finite nucleon sizes are included. The theory is applied to the deuteron quadrupole moment, the low-energy photonuclear reaction $\gamma + d \rightarrow n + p$, and elastic electron-deuteron scattering. It is shown that these phenomena can be given a consistent phenomenological treatment under the simplest assumptions. (auth)

2454

RADIATION WIDTHS OF LEVELS IN NUCLEI NEAR CLOSED SHELLS. A. Stolovy and J. A. Harvey (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 108, 353-61(1957) Oct. 15.

An experimental investigation has been made of the variations in the radiation widths of nuclear energy levels for isotopes in the regions of the neutron magic numbers, where fluctuations in level spacing and neutron binding energy are largest. Neutron transmission measurements were made using the Brookhaven fast chopper, and the Breit-Wigner level parameters were obtained for resonances in the following target isotopes: Sr^{87}, Sb^{121}, Sb^{123}, Ba^{135}, La^{139}, Nd^{145}, and Pt^{195}. Other elements around closed neutron shells, namely, Rb, Zr, Nb, Ce, and Tl, were examined but no accurate measurements could be made of the radiation widths for these elements. Results show that the fluctuations in the measured radiation widths are small compared to the large fluctuations in neutron scattering widths, and that they are related to the level spacing and the effective level excitation energy. An effect arising from the closed shells at 82 and 126 neutrons is observed. Analysis of all the available "good" data indicates that the essential features of the theory of Blatt and Weisskopf are generally valid; that is, radiation widths are strongly dependent on the effective level excitation energy and weakly dependent on the level spacing. Experimental results are compared with predictions from semiempirical formulas. (auth)

2455

POLARIZATION PHENOMENA IN THE ONE-QUANTUM ANNIHILATION OF POSITRONS AND THE PHOTOELECTRIC EFFECT. Kirk W. McVoy (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 108, 365-9(1957) Oct. 15.

Cross sections are derived for the one-quantum annihilation of longitudinally-polarized positrons and for the photoelectric effect with longitudinally-polarized photons. Simple expressions, quantitatively reliable for light elements, are obtained by considering only K-shell electrons and describing the outgoing electron (incoming positron) by plane waves. In both cases, the incoming and outgoing

particles have predominantly the same helicity if the free Dirac particle is relativistic. In a note added in proof, these calculations are extended to the case of elliptically polarized radiation. For linearly polarized photons, the results are compared with those obtained by including lowest-order Coulomb corrections to the continuum wave function of the electron, as given by Sauter in 1931. The difference in the angular distribution is very marked, and indicates a sensitive dependence on the degree of screening of the Coulomb field. (auth)

2456

INELASTIC SCATTERING FROM AND (p,α) REACTIONS OF THE COPPER ISOTOPES. M. Mazari, W. W. Buechner, and R. P. de Figueiredo (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 108, 373-7(1957) Oct. 15.

The excited states of Cu^{63}, Cu^{65}, Ni^{60}, and Ni^{62} have been investigated through studies of the proton and alpha-particle groups emitted from isotopically enriched targets of copper. A 6.51-Mev proton beam from an electrostatic accelerator and a high-resolution magnetic spectrograph were used in the investigation. The regions of excitation studied were from the ground state to 3.5 Mev in the case of Cu^{63}, 3.1 Mev for Cu^{65}, 3.7 Mev for Ni^{60}, and 3.5 Mev for Ni^{62}. The Q value for the $Cu^{63}(p,\alpha)Ni^{60}$ reaction is 3.753 ± 0.008 Mev and for the $Cu^{65}(p,\alpha)Ni^{62}$ reaction, 4.341 ± 0.008 Mev. (auth)

2457

SHORT-LIVED ISOMERS OF As^{75} AND As^{77}. Alois W. Schardt (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 108, 398-406(1957) Oct. 15.

Sources of Se^{75} and Ge^{77} have been investigated by delayed-coincidence techniques for short-lived isomeric levels in the daughter nuclei As^{75} and As^{77}, respectively. The 0.305-Mev level of As^{75} has a half-life of 17 milliseconds and is depopulated by a 0.025-Mev M2 transition (90%) in competition with a 0.305-Mev E3 transition (10%). The 0.475-Mev level of As^{77} has a half-life of 116 microseconds and is depopulated by a 0.210-Mev M2 transition. An upper limit of 2% of the isomeric decays was placed on the intensity of any possible 0.475-Mev ground-state transition. In the beta decay of Ge^{77} to As^{77}, gamma rays of the following energies were found to feed the metastable state: 0.153, 0.709, 1.08, and 1.50 Mev and probably also 0.92 and 1.96 Mev. The data obtained have been incorporated in a recently proposed decay scheme of Ge^{77}. The previously discovered isomeric transition in As^{73}, as well as those in As^{75} and As^{77}, are probably all M2 transitions between $\frac{3}{2}+$ $\frac{5}{2}-$ levels, with transition probabilities of 0.9, 1, and 0.6%, respectively, of the shell-model single proton transition probability. (auth)

2458

INELASTIC SCATTERING OF 4-Mev PROTONS AND DEUTERONS FROM SEPARATED ISOTOPES OF Dy^{161}, Dy^{163}, Yb^{171}, AND Yb^{173}. B. Elbek, K. O. Nielsen, and M. C. Olesen (Univ. of Copenhagen, Denmark). Phys. Rev. 108, 406-10(1957) Oct. 15.

The inelastic scattering of protons and deuterons from the odd isotopes of Dy and Yb has been measured at energies around 4 Mev in a heavy-particle spectrometer at a scattering angle of 145°. Isotopically pure targets were prepared in an electromagnetic isotope separator. Inelastic groups corresponding to the two lowest rotational states were observed in Dy^{161} at 44 kev and 102 kev, in Dy^{163} at 74 kev and 170 kev, in Yb^{171} at 67 kev and 76 kev, and in Yb^{173} at 78 kev and 181 kev. The reduced electric quadrupole transition probabilities for these levels were determined. (auth)

2459

MESONIC ATOMS: RADIATIVE YIELDS OF THE π-MESON L SERIES. M. B. Stearns, M. Stearns, and L. Leipuner (Carnegie Inst. of Tech., Pittsburgh). Phys. Rev. 108, 445-9(1957) Oct. 15.

The total radiative yields of the L series from π-mesonic atoms have been measured for most of the elements $_5$B through $_{33}$As. The yield curve has a broad maximum of ~ 70% in the region $12 \lesssim Z \lesssim 16$ and decreases at both higher and lower Z values. This decrease is presumably due to competition from direct nuclear absorption at the higher Z's and to nonradiative processes at the lower Z's. The yields are fairly constant for $25 \lesssim Z \lesssim 30$, suggesting a possible magic number effect at Z = 28. The rapid decrease in yield with decreasing Z cannot be attributed to competition between the simple Auger effect and radiative transitions. The simple Auger transition probabilities are about 40 times smaller than the observed values. More complex nonradiative processes are probably involved, such as those proposed by Day and Morrison. (auth)

2460

CONTRIBUTION OF RECOIL TO CHARGE DISTRIBUTION OF NUCLEONS. H. Suura (Inst. for Advanced Study, Princeton, N. J.). Phys. Rev. 108, 470-6(1957) Oct. 15.

Mean-square radii of the charge distribution of nucleons are obtained in closed form in terms of meson field operators, by applying a certain transformation to a relativistic one-nucleon theory. They are evaluated by using the pion distribution as given by a modified extended-source theory which takes into account part of the recoil energy of the nucleon. Such a theory derives from the original one-nucleon theory as a result of an expansion in inverse powers of the nucleon mass. The result shows that the radius of the nucleon core, which arises solely from recoil, is much smaller than the one inferred from electron-proton scattering experiments. On the other hand, the recoil correction to the static charge distribution of the pion cloud is negative and so large as almost to cancel the latter. (auth)

2461

ON A RATIONAL SYSTEM OF SYMBOLS FOR FUNDAMENTAL PARTICLES. Ia. P. Terletskii (Moscow State Univ.). Soviet Phys. JETP 4, 575-6(1957) May.

The quantities, E, ϵ, n, and ν are named thus: E = electric number, ν = neutrinic number, n = barionic number, and λ = -ν, the leptonic number. Since the numbers E, ϵ, n, and λ determine the place of the particle in the schematics, its basic properties, and its allowed formation and decay reactions, it is considered rational to introduce these numbers into the symbols describing the elementary particles. It is proposed to write the numbers E, ϵ, n, and λ as indices of the symbol Z of the particles, according to the scheme: ${}^{\lambda}_{n}Z^{E}_{\epsilon}$. (M.H.R.)

2462

MULTIPLE FORMATION OF PARTICLES IN 5.3 Bev NUCLEON-NUCLEON COLLISIONS. V. M. Maksimenko and A. I. Nikishov (Academy of Sciences, USSR). Soviet Phys. JETP 4, 614-16(1957) May.

The distribution of nucleon-nucleon collisions at 5.3 Bev was calculated theoretically from the number of secondary particles, using the statistical theory of multiple-particle formation with and without the isobar states. A method was employed in the calculations with which statistical weights can be accurately calculated. The percentage statistical weights of the various processes and a classification by charged states are given. (M.H.R.)

2463

RELATION BETWEEN THE ANGULAR DISTRIBUTIONS OF PARTICLES AND THEIR DECAY PRODUCTS. Iu. D. Prokoshkin (Academy of Sciences, USSR). Soviet Phys. JETP 4, 618-19(1957) May.

In a number of cases where it is impossible to obtain direct information about the process of formation of interactions of particles, because of their short lifetime, it is essential to know how the distributions of the initial and secondary (decay) particles are related. The practically important case is considered, where the speed of the secondary particles is that of light and the angular distributions of the initial particles W ($\cos\theta$, φ) does not depend on the azimuthal angle and can be represented as a linear combination of terms of the type $W_n = \frac{1}{2}(n + 1) \cos^n\theta \times$ (n-integer). (M.H.R.)

2464

BEHAVIOR OF PARTICLES WITH NONZERO SPIN IN CROSSED CONSTANT AND VARYING MAGNETIC FIELDS. A. I. Rivin. Soviet Phys. JETP 4, 619-20(1957) May.

An exact solution for the behavior of particles of arbitrary spin in crossed constant and varying magnetic fields is given. (M.H.R.)

2465

CONCERNING THE SPIN OF THE Λ°-PARTICLE. M. I. Shirokov (Academy of Sciences, USSR). Soviet Phys. JETP 4, 620-2(1957) May.

Several general formulas obtained by methods previously described are presented, with relation to the problem of determining the spin of the Λ° particle from the angular distribution of its decay product. (M.H.R.)

Nuclear Properties

2466 CF-57-8-9

Oak Ridge School of Reactor Technology, Tenn.

ESTIMATION OF RESONANCE INTEGRALS. Edward Kuhn. Aug. 1957. 27p. $4.80(ph OTS); $2.70(mf OTS).

A statistical model which takes into account reduced neutron width fluctuations is used to calculate resonance integrals for non fissile isotopes of mass number ≥ 100. Calculated values are then compared with the latest experimental values. (auth)

2467 HW-51966

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

EFFECTIVE NEUTRON REPRODUCTION FACTORS FOR RECYCLED PLUTONIUM AND URANIUM. R. E. Peterson and R. L. Reynolds. Sept. 25, 1957. 11p. Contract [W-31-109-Eng-52]. $3.30(ph OTS); $2.40 (mf OTS).

The number of neutrons released per neutron absorbed was calculated for Pu and U as a function of both straight exposure and recycle exposure (fission products discarded periodically). (T.R.H.)

2468 NDA-86-1

Nuclear Development Corp. of America, White Plains, N. Y.

THE NEUTRON CROSS SECTIONS OF NITROGEN. H. Lustig, H. Goldstein, and M. H. Kalos. June 30, 1957. 41p. For [Oak Ridge National Lab. Contract W-7405-eng-26], Subcontract 1069. $6.30(ph OTS); $3.00(mf OTS).

Cross sections for neutron interactions with nitrogen are tabulated in the energy range from zero to 18 Mev. The total cross section, the neutron disappearance cross section, and the cross sections for elastic and inelastic scattering are given, together with coefficients for a Legendre expansion of the elastic scattering angular distribution. (auth)

2469

MEASUREMENT OF THE Xe^{135} CROS SECTION AND U^{235} FISSION YIELD OF I^{135}. G. R. Hopkins and C. P. Jamieson (Westinghouse Electric Corp., Pittsburgh). J. Appl. Phys. 28, 1362-3(1957) Nov.

2470

THE INDEPENDENT YIELDS OF ^{140}La, ^{90}Y, AND ^{91}Y IN THE THERMAL NEUTRON FISSION OF ^{235}U AND ^{233}U. W. E. Grummitt and Gwen M. Milton (Atomic Energy of Canada, Ltd., Chalk River, Ontario). J. Inorg. and Nuclear Chem. 5, 93-104(1957).

The independent yields of La^{140} have been radiochemically determined for the thermal neutron fission of U^{235} and U^{233} to be 4.5×10^{-3} % and 2.4×10^{-2} %, respectively. A study of the hypotheses advanced to date concerning charge distribution in fission has indicated that the equal charge displacement postulate still gives the best agreement with experimental values, although additional data may prove this to be fortuitous. The La^{140} yields are considerably lower than the values estimated from this postulate, as is to be expected for an 83 neutron configuration if closed shell species are favored in the fission process. An investigation of the apparent independent yield of Y^{91} has produced evidence that some mechanism other than direct formation has contributed to the high yields observed. Attempts have been made to measure the independent yield of Y^{90}, and an upper limit of 4×10^{-4} % has been estimated for U^{235} and U^{233} fission. If, however, selectivity does exist in the region of closed shells, Y^{90} yields much below these limits can be anticipated due to the effects of the 50 neutron shell. (auth)

2471

MEASUREMENTS ON ELECTROMAGNETICALLY SEPARATED RADIOACTIVE ISOTOPES OF IODINE. P. AAg Aagaard, G. Anderson, J. O. Burgman, and A. C. Pappas (Gustaf Werner Inst. for Nuclear Chemistry, Uppsala, Sweden). J. Inorg. and Nuclear Chem. 5, 105-11(1957).

The mass range 124 to 135 of iodine isotopes formed in 170-Mev proton-induced fission of uranium has been studied using an electromagnetic isotope separator to prepare mass-determined samples for Geiger-Müller counting. Relative formation cross sections are given for the shielded nuclides: 12.6 hr I^{130} (1.0), 25 min I^{128} (0.7), 13 day I^{126} (0.4), and 4 day I^{124} (0.1). The presence of a (2.6 ± 0.8) hr half life in the mass 126 decay curve may indicate isomerism in I^{126}. Neutron deficient iodine isotopes down to mass number 118 were separated from spallation products of cesium. The following mass assignments are reported: I^{119} (19 min), I^{120} (1.4 hr), and I^{121} (2.0 hr). (auth)

2472

EXCITED STATES OF N^{16}. Joan M. Freeman and R. C. Hanna (Atomic Energy Research Establishment, Harwell, Eng.). Nuclear Phys. 4, 599-614(1957) Oct.

The first four levels of N^{16}, excited by the reaction N^{15}(d, p)N^{16}, have been studied by observing proton groups and gamma radiation, coincidences and angular correlations. The following spins and energies have been assigned to the excited states: 0− at 120 ± 1 kev, 3− at 298 ± 5 kev, and 1− at 395 ± 3 kev. The half life of the 120 kev level is 6.7 ± 0.5 microseconds. The results are in excellent agreement with the shell-model predictions of Elliott and Flowers. (auth)

2473

ON THE DECAY SCHEME OF AcX (Ra^{223}). I. INVESTIGATION OF THE GAMMA SPECTRUM BY MEANS OF SCINTILLATION SPECTROMETRY. H. Paul. Öester. Akad. Wiss. Math. naturw. Kl. Anz. 94, 199-215(1957). (In German)

The gamma scintillation spectrum of AcX (in equilibrium with its daughter products) was measured, and the spectrum

of the active deposit was subtracted from it. The energies of the gamma peaks (some of which are complex) and their intensities per decay (in brackets) are: 84 kev (0.53 ± 0.1, x-ray), 148 kev (0.12 ± 0.05), 268 kev (0.15 ± 0.03) and 330 kev (0.09 ± 0.05); (energies ± 3 kev). The intensities were determined relative to the intensity of the AcC gamma line. They agree within a factor 2 with those given by Bayman and Ross. There is good agreement with Frilley's relative intensities. A source of AcX with daughter products was also used for gamma-gamma coincidences. Lines at 120, 186, and 239 (all ± 10) kev were found in coincidence with the 148-kev maximum, the 120-kev line being in coincidence mainly with the lower energy component of this (complex) maximum. The strong AcX gamma lines of 148, 268, and 330 kev are not in coincidence with each other. It follows from this and also from the sum of the measured electromagnetic intensities that cascades must have comparatively small intensities. Hence the 5.86 Mev alpha line is very likely to lead to the ground state. All results agree with decay scheme "a" proposed by Bayman and Ross. The non-linear pulse height-energy relation of the NaI(Tl) crystal used agrees with that found by Engelkemeir. (auth)

2474

HYPERFINE STRUCTURE AND QUADRUPOLE MOMENT OF LANTHANUM-139. Yu Ting (National Research Council, Ottawa, Can.). Phys. Rev. 108, 295-304(1957) Oct. 15.

The hyperfine structure of La^{139} in the ground level $5d6s^2\ ^2D$ was studied by the atomic-beam magnetic resonance method. The beam of La atoms was detected by a hot W filament operated at 2680 ± 30°K. Of the eight hyperfine intervals resulting from the interaction of a nuclear spin of $^7/_2$, with the J values of the ground state, seven have been measured. They are, for $J = {}^5/_2$,

$\nu_1 = W(F = 6) - W(F = 5) = 1120.902 \pm 0.005$ Mc/sec,
$\nu_2 = W(F = 5) - W(F = 4) = 912.793 \pm 0.005$ Mc/sec,
$\nu_3 = W(F = 4) - W(F = 3) = 716.288 \pm 0.003$ Mc/sec,
$\nu_4 = W(F = 3) - W(F = 2) = 529.090 \pm 0.010$ Mc/sec,

and for $J = {}^3/_2$,

$\nu_5 = W(F = 5) - W(F = 4) = 737.967 \pm 0.015$ Mc/sec,
$\nu_7 = W(F = 4) - W(F = 3) = 551.987 \pm 0.005$ Mc/sec,
$\nu_8 = W(F = 3) - W(F = 2) = 391.608 \pm 0.010$ Mc/sec.

From these values the magnetic dipole interaction constants are found to be A' $(J = {}^5/_2) = 182.1706 \pm 0.0006$ and A'' $(J = {}^3/_2) = 141.1959 \pm 0.0016$ Mc/sec, the quadrupole interaction constants to be $B' = 54.213 \pm 0.014$, and $B'' = 44.781 \pm 0.014$ Mc/sec, while the octupole interaction constants are zero within the accuracy of the present experiment. The unobserved line of the $^2D_{5/2}$ hyperfine multiplet is calculated to be $\nu_6 = W(F = 2) - W(F = 1) = 348.843 \pm 0.014$ Mc/sec. A serious discrepancy was noted between the observed A values, both relatively and absolutely, and those given by theory. The assumption of s-configuration mixing apparently resolved this difficulty. The values of nuclear quadrupole moment calculated from B' and B'' are fairly consistent with each other. The average value, after application of the Sternheimer correction is $Q = (0.268 \pm 0.010) \times 10^{-24}$ cm^2. (auth)

2475

SPIN, PARITY, AND j-j EXPANSION COEFFICIENTS FOR STATES OF LOW EXCITATION IN O^{18}. O. M. Bilaniuk and P. V. C. Hough (Univ. of Michigan, Ann Arbor). Phys. Rev. 108, 305-10(1957) Oct. 15.

A study of the angular distributions and of relative intensities of proton groups from the reaction $O^{17}(d,p)O^{18}$ has established even parity and total angular momenta of 0, 2, and 4 for the lowest three known states in O^{18}. These results, as well as the d-wave stripping intensities, are in remarkable agreement with theoretical predictions of Redlich and of Elliott and Flowers. A mixed s-d angular distribution for the first excited state is shown to determine sensitively the coefficients of the $d_{5/2}s_{1/2}$ and $(d_{5/2})^2$ terms in a j-j expansion of the wave function for this state. (auth)

2476

BINDING ENERGIES OF HEAVY NUCLEI. R. Thieberger (Weizmann Inst. of Science, Rehovoth and Israel Atomic Energy Commission, Tel Aviv) and A. de-Shalit (Weizmann Inst. of Science, Rehovoth, Israel). Phys. Rev. 108, 378-83 (1957) Oct. 15.

Nuclear binding energies of heavy nuclei are calculated from a general two-body interaction by using j-j coupling shell-model wave functions for the nucleons. The formula obtained can be made to fit experimental data with a high accuracy. (auth)

2477

ENERGY LEVELS IN FLUORINE-19 NUCLEUS. Anwar Hossain and A. N. Kamal (Univ. of Dacca, East Pakistan). Phys. Rev. 108, 390-2(1957) Oct. 15.

Nuclear emulsion technique has been employed to determine the energy levels in F^{19} with the help of an incident proton beam of 9.5-Mev energy from the Birmingham cyclotron. Energy levels in F^{19} have been obtained at 1.36 ± 0.02, 1.55 ± 0.01, 2.83 ± 0.02, 3.92 ± 0.04, 4.06 ± 0.05, 4.57 ± 0.02, 4.76 ± 0.05, 5.27 ± 0.02, 5.53 ± 0.03 and 6.07 ± 0.02 Mev. In addition, possible levels at 4.95 ± 0.02 and 6.50 ± 0.09 Mev have been detected. (auth)

2478

SPONTANEOUS FISSION NEUTRON SPECTRUM OF Cf^{252}. A. B. Smith and P. R. Fields (Argonne National Lab., Lemont, Ill.) and J. H. Roberts (Northwestern Univ., Evanston, Ill.). Phys. Rev. 108, 411-13(1957) Oct. 15.

The spontaneous fission neutron spectrum of Cf^{252} from 0.2 to 7.0 Mev has been measured. Time-of-flight techniques were employed to determine the lower energy portion of the spectrum while proton recoils in emulsions were used to study the higher energy neutrons. The measured neutron spectrum is, within the experimental accuracy, described by the empirical relation $N(E) \propto \exp[-0.88E(\text{Mev})] \sinh[2.0E(\text{Mev})]^{1/2}$, where N(E) is the number of neutrons of energy E per unit energy interval. The experimental results are compared with the theoretically determined Cf^{252} fission neutron spectrum. (auth)

2479

NEUTRON TOTAL CROSS SECTIONS OF CHROMIUM AND IRON IN THE kev REGION. Carl T. Hibdon (Argonne National Lab., Lemont, Ill.). Phys. Rev. 108, 414-21(1957) Oct. 15.

The neutron total cross sections of chromium and iron have been measured in the energy range from one to 410 kev using neutron energy spreads from about 0.3 to 0.7 kev. Variations in the cross section of chromium show the presence of many resonances; seven of them in the region between 3 and 11 kev are due to neutron reactions with Cr^{53}, and many others at higher energies are attributable to Cr^{53} and other less abundant isotopes. Eleven resonances are due to s-wave neutron reactions with Cr^{52}. The results are similar for iron. Fourteen, or possibly fifteen, resonances are due to s-wave neutron reactions with Fe^{56}. The values of the strength function of Cr^{52} and Fe^{56} for a well depth of approximately 40 Mev are 1.3 and 1.5×10^{-4}, respectively, and for Cr^{53} it appears to be much higher. A new technique for analysis of s-wave neutron scattering resonances has been developed. (auth)

2480

ENERGY LEVEL SPECTRUM OF C^{15} FROM THE NUCLEAR REACTION $Be^{9}(Li^{7},p)C^{15}$. P. G. Murphy (Univ. of Chicago, Ill.). Phys. Rev. 108, 421-6(1957) Oct. 15.

Energy levels of the nucleus C^{15} have been measured by measuring the kinetic energies of proton groups produced in the bombardment of thin beryllium targets with 2-Mev lithium ions, causing the reaction $Be^{9}(Li^{7},p)C^{15}$. The energy levels found were at 0.62, 2.48, 3.08, 4.26, 5.93, 6.58, and 8.18 Mev above the ground state. A continuum of particles was interpreted as due partly to $Be^{9}(Li^{7},pn)C^{14}$. The ground state and the lowest levels were compared with levels in N^{15}; the presence of the lowest $T = 3/2$ level at 11.61 Mev in N^{15} was confirmed. Comparison with the low-lying levels in O^{17} revealed similarity suggested by the analogous shell structures of the two nuclei C^{15} and O^{17}. (auth)

2481

ANOMALOUS MAGNETIC MOMENTS OF NUCLEONS. G. N. Vialov (Academy of Sciences, USSR). Soviet Phys. JETP 4, 562-5(1957) May.

Calculations are presented for the anomalous magnetic moment of nucleons in which the excited nucleon states with spin 3/2 and isotopic spin 3/2 are included. Divergent expressions were obtained which were regularized with the aid of Feynman factors. The cut-off parameter can be so selected that agreement between theory and experiment is obtained. (auth)

2482

INVESTIGATION OF NUCLEAR ENERGY LEVELS BY MEASURING THE ANGLE OF EMISSION OF THE REACTION PRODUCTS. A. F. Tulinov (Moscow State Univ.). Soviet Phys. JETP 4, 596-7(1957) May.

The experimental realization of the method of investigation and its testing by studying the known reactions $Be^{9}(d,p)Be^{10}$ and $Be^{9}(d,H^{d})Li^{7}$ are discussed. (M.H.R.)

2483

THE ACTIVATION CROSS SECTION OF Tm^{170} AND THE DETERMINATION OF THE RELATIVE INTENSITY OF THE PHOTONS. Hans Houtermans. Z. Physik 149, 215-24(1957). (In German)

Nuclear Reactors

Refer also to abstract 2221.

2484 AECU-3575

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

IRRADIATED FUEL ASSEMBLY SHIPPING CONTAINER; FUNCTIONAL REQUIREMENTS. [Apr. 1957]. 8p. (FR-0296-C). $1.80(ph OTS); $1.80(mf OTS).

The design of an irradiated fuel assembly shipping container which is to be used to ship one complete PWR fuel assembly to a laboratory for examination and testing is presented. (W.L.H.)

2485 AECU-3576

[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]

VALVE OPERATING SYSTEM; SYSTEM DESCRIPTION NO. 10. May 1957. 68p. $12.30(ph OTS); $4.50(mf OTS).

For inclusion in Vol. II of the Shippingport Atomic Power Station Manual.

A description is given of the valve operating system for the PWR. The valves served by this system are a component part of the following systems: reactor coolant system; pressurizer and pressure relief system; coolant discharge and vent system; and failed element detection and location system. (W.L.H.)

2486 AECU-3589

Division of Reactor Development, Engineering Development Branch, AEC.

REACTOR SAFETY BIBLIOGRAPHY—SELECTED UNCLASSIFIED REFERENCES. Oct. 31, 1957. 18p. $3.30 (ph OTS); $2.40(mf OTS).

2487 AERE-ED/R-1882

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

HYDRAULICALLY PACKED, INVERTED SPHERE BEDS. D. A. Garton and Frank Sterry. Oct. 1956. 28p.

An inverted flow-packed bed of spheres was investigated as a possible nuclear reactor core arrangement. The consistency and stability of voidage, pressure loss, and the fluid velocity ratio between packing and unpacking the bed by flow manipulation were studied. (T.R.H.)

2488 ANL-5781

Argonne National Lab., Lemont, Ill.

HAZARD SUMMARY REPORT ON THE EXPERIMENTAL BOILING WATER REACTOR (EBWR). J. M. West, J. R. Dietrich, A. S. Jameson, G. A. Anderson, J. M. Harrer, and H. F. Brush. 226p. Contract W-31-109-eng-38. $5.50(OTS).

In addition to the nine cross-shaped control rods which pass through vertical guide channels in the core, a secondary noninherent safety mechanism in the form of a pressurized concentrated boric acid solution can reduce the reactivity by at least 12.5% k in about 20 seconds. With regard to inherent safety, the EBWR has a much stronger metal temperature coefficient, but a considerably weaker steam formation shutdown mechanism, than the Borax reactors. Estimates were made of the amount of reactivity which can be controlled by steam formation in the EBWR. The maximum heat flux in EBWR is believed to be below the burnout point by at least a factor of 4 to 5, based on laboratory tests with electrically heated plates. The EBWR is surrounded by a gas-tight steel building having a volume of about 400,000 ft^3 and designed to withstand an internal pressure of 15 psig. A 15,000-gal reservoir of water is suspended from the dome of the building for emergency cooling. The gas-tight building could easily withstand the internal pressure resulting from blowdown of the pressurized water in the reactor. The major design and operating features of the EBWR facility are summarized. (M.H.R.)

2489 BAW-1001

Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.

LIQUID METAL FUEL REACTOR EXPERIMENT. Quarterly Technical Report No. 1 [for] July 1, 1956 to November 15, 1956. 48p. Contract AT(30-1)-1940. $7.80(ph OTS); $3.30(mf OTS).

Initial progress in the LMFRE program is reported. Progress was limited to the establishment of objectives, determining the required research and development, and selecting preliminary design parameters. In order to determine optimum core and reflector parameters, a survey was made of the critical sizes of U—Bi—C reactors. Twenty-seven cylindrical cores with Bi/C ratios of 0.4, 0.7, and 1.0, and diameters from 3.0 to 5.5 ft were considered, and U^{235} critical masses and flux distributions were obtained. Considerations of variables which effect power level led to the preliminary selection of 20 Mw for LMFRE. A flow diagram and a discussion of a fluoride volatility process for possible application to U—Bi fuels are included. (D.E.B.)

2490 BLWR/N-11

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

PRELIMINARY NUCLEAR CALCULATIONS FOR A PRESSURIZED LIGHT WATER REACTOR WITH URANIUM OXIDE FUEL. C. B. Crockett. Mar. 16, 1956. 22p.

The results of nuclear calculations for a H_2O moderated and cooled pressurized reactor are presented. Curves are included showing the effect on critical mass and conversion factor of such variables as fuel rod diameter, lattice geometry and initial fuel enrichment. The fuel is in the form of solid cylindrical rods of UO_2. A rough economic survey based on these results indicates that an economical reactor giving 400 Mw of heat should be possible with fuel rods one inch in diameter and initial enrichment of 1.6 to 1.7%. (auth)

2491 BMI-1229

Battelle Memorial Inst., Columbus, Ohio.

SUPPLEMENTARY MODEL STUDIES OF FLOW DISTRIBUTION IN THE CORE OF THE PWR REACTOR. Lawrence J. Flanigan and Herbert R. Hazard. Oct. 7, 1957. 35p. Contract W-7405-eng-92. $1.25(OTS).

Air-flow studies were run in a quarter-scale flow model of the PWR reactor to determine distribution of flow throughout the core with three configurations of the core and flow baffle. For each configuration tests were run to simulate operation with four loops, three loops, and two opposed loops, and two adjacent loops. The effect of the flow baffle under the core was investigated in two groups of tests with full core pressure loss, one group with the flow baffle installed, and one group without the flow baffle. Flow distribution with the flow baffle was considerably better than that without the flow baffle. In tests with the flow baffle, no cluster received less than 97% of the average flow for the region in which it was located. In tests without the baffle, for operation with two loops, flow in a number of clusters ranged from 89 to 110% of average flow. The reduction of core resistance by removing core-inlet orifices did not materially change flow distribution. (auth)

2492 CF-56-8-203

Oak Ridge School of Reactor Technology, Tenn.

A LOW COST PHYSICS AND ENGINEERING TRAINING REACTOR. Reactor Design and Feasibility Study. R. A. Brown, M. W. Ackerman, J. F. Batter, Jr., D. W. Bell, J. B. Dunlay, G. K. Ellis, E. I. Nowstrup, and L. W. Pokallus. Aug. 1956. 199p. $5.50(OTS).

The conceptual design of a low cost training reactor for the instruction of physicists and engineers is covered. It is conceived as an instructional tool for a course such as that given at the Oak Ridge School of Reactor Technology. The reactor is of a modified pool type, and is designed for a maximum power level of one Mw. This arrangement will accommodate engineering experiments, shielding experiments, and critical experiments as well as being useful as a neutron and gamma source. (auth)

2493 CF-56-9-109

Oak Ridge National Lab., Tenn.

PROPOSED MULTIPLE IN-PILE ROCKING BOMB EXPERIMENT. R. J. Davis, D. T. Jones, and F. J. Walter. Sept. 27, 1956. 18p. Contract [W-7405-eng-26]. $3.30 (ph OTS); $2.40(mf OTS).

Experiments are proposed to study the effects of reactor radiation at elevated temperatures on the stability and corrosive properties of aqueous fuel systems. A general description of the experiment, its hazards, and safeguards is given. (M.H.R.)

2494 CF-57-11-39

Oak Ridge National Lab., Tenn.

MANUAL OF ROUTINE AND EMERGENCY OPERATING PROCEDURES FOR THE TOWER SHIELDING FACILITY. F. N. Watson, C. E. Clifford, M. J. Welch, J. L. Hull, and V. R. Cain. Nov. 25, 1957. 36p. Contract W-7405-eng-26. $6.30(ph OTS); $3.00(mf OTS).

Routine and emergency procedures are presented along with a discussion of some of the philosophies which have dictated their use. The same procedures are outlined in the appendices, without discussion, for ready reference. Since reloading the reactor fuel elements induces some unusual hazards, a separate section is devoted to the loading procedures. In the appendices, a safety channel check list is given without discussion and the method of checking the safety channels with neutrons is discussed. (auth)

2495 CRL-46

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

ALUMINUM SHEATHING OF FLAT URANIUM PLATES BY EXTRUSION CLADDING. A. J. Mooradian. Nov. 1957. 44p. (AECL-513).

Presented before the Symposium on Fuel Element Fabrication, Paris, France, November 18-23, 1957.

The aluminum sheathing of long flat U metal fuel elements by means of extrusion cladding was developed to the point of trial production. The process consists of using the U flat as a moving mandrel over which the sheath is extruded directly, thereby completely encasing the U with Al as it passes through the die. Although the sheath may be extruded directly to size, for production reasons it is found to be preferable to extrude the sheath oversized (0.254 cm. thick) and machine it to the required thickness (0.063 cm.) as a second operation. Bonding of the sheath to the core may be achieved in the course of extrusion. The bond is stronger and more uniform in the case of a U plate which has been Ni plated than in the case of bare U. However, in both cases the sheath is found to be in good sonic contact with the core. Both Ni plated and bare U flat elements sheathed in Al by the extrusion cladding method have been successfully tested under irradiation. There was no evidence of poor thermal transmission through the U–Al interface under the test condition of 47 watts/cm^2. The method has been developed for cladding all three sizes of flat plates used in making up the fuel rods for N.R.U. (auth)

2496 CRL-47

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

THE PREPARATION AND SHEATHING OF PLUTONIUM–ALUMINUM FUEL ALLOYS FOR THE N.R.X. REACTOR. C. J. C. Runnals and K. L. Wauchope. Nov. 1957. 18p. (AECL-514).

Presented before the Symposium on Fuel Element Fabrication, Paris, France, Nov. 18-23, 1957.

Several different types of Pu–Al fuel rods have been fabricated for irradiation in the Chalk River N.R.X. reactor. The first three elements each contained 350 g of Pu as cast Pu–Al alloys, with an approximate sine-squared distribution of the Pu along a ten-foot length. The next twenty-three elements were composite assemblies of a cast 20 wt. % Pu–Al center section containing 180 g of Pu and two detachable Al-clad natural U metal cylinders, each three feet long. The most recent design consists of a ten-foot long stack of cast and machined Al-clad cylinders containing 265 g of Pu uniformly dispersed as a 3.7 wt. % Pu–Al alloy. Ten rods of the latter type had been fabricated. Two alloy preparation methods which eliminated the Pu metal production step were developed. Alloys for

the first rod were made by reducing PuF_3 with an Al excess, at 900°C. A simpler technique, namely the Al reduction of PuO_2 in the presence of cryolite, was used for all later fuel alloy preparations. The methods of alloying, melting, casting, machining, fabrication and testing are described, with particular emphasis on those currently in use at Chalk River. (auth)

2497 CRR-644-3

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

PROCEEDINGS OF THE TRIPARTITE REACTOR CORE CONFERENCE HELD AT CHALK RIVER, ONTARIO, JANUARY 9-12, 1956. PART 3. RECONCILIATION OF CALCULATIONS FROM BASIC CROSS-SECTION DATA WITH EXPERIMENTAL RESULTS FOR STANDARD LATTICE TYPES. J. W. Greenwood, and J. E. Woolston, eds. Aug. 1957. 125p.

Papers are presented on the core parameters of graphite and water moderated reactors; criticality calculations for homogeneous reflected hydrogenous reactors in terms of Fourier-Transform slowing-down distributions; the experimental basis of lattice calculations for water moderated assemblies; D_2O-U lattices; and the influence of vacant lattice positions on the dynamic diffusion area of NRX: an approximate calculation. (M.H.R.)

2498 DL-S-191

Duquesne Light Co., Shippingport, Penna.

SHIPPINGPORT ATOMIC POWER STATION ORGANIZATION AND TRAINING. C. F. Jones. May 1957. 68p. Contract AT(11-1)-292. $1.75(OTS).

Supplemental to WAPD-SC-541.

A detailed breakdown is presented of the Shippingport Atomic Power Station personnel organization including organizational structure, the functions of the various groups, major responsibilities and individual job descriptions. A detailed description of the training program and the areas and methods of instruction are included. (C.H.)

2499 ERG-11

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

NATURAL URANIUM REACTORS ECONOMIC FACTORS IN POWER PRODUCTION. R. V. Moore. Aug. 31, 1950. 13p.

The cost of an electrical unit sent out from a 90 Mw nuclear power station is compared with that from a coal fired station of the same output, estimates being based on current capital and fuel costs for both coal fired and nuclear stations. (M.H.R.)

2500 FRDC/P-252

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

REACTIVITY EFFECTS CONTROLLED BY THE BORON SHUT-OFF AND BORON OSCILLATOR IN THE FAST REACTOR. A. R. Baker. Sept. 1957. 5p.

A new estimate was made for the reactivity controlled by three shut-off rods in the Dounreay Fast Reactor, namely $(0.82 \pm 0.08)\%$. The increase of 50% on the previous figure is mainly due to an over-estimate of self-shielding in the earlier work. Rotation of the proposed B^{10} oscillator will produce a peak-to-peak oscillation in reactivity of 0.010% (with a possible error of a factor of two). This will be satisfactory for the Dounreay equipment for measuring the phase and amplitude of the power oscillation. (auth)

2501 FSG-59

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A PROPOSAL FOR COMPOSITE FUEL ELEMENTS. C. A. Rennie. Nov. 15, 1956. 14p. (FRDC-P-208).

A proposal is made for a composite type of fuel element, comprising a tube of fertile material filled with a fissile material alloy which, if it can be successfully developed, would seem to have some advantages for use in fast reactors, running on the Pu-U cycle. (auth)

2502 HARD(A)/P-33

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE USE OF THE HOMOGENEOUS AQUEOUS SYSTEM AS A BURNER REACTOR. C. L. Brown, P. N. Cooper, J. R. Harrison, and D. Newby. Sept. 1957. 34p.

An investigation was made of single zone homogeneous reactors for power production in the range 5 to 10 Mw (E) for periods up to 25 years. An outline examination of the engineering shows that natural convection systems, in which the pump is eliminated, should be considered as well as the forced circulation system. Physics calculations were made in order to estimate the fuel and moderator costs, assuming no depoisoning. Power costs, based on fuel and moderator alone were calculated for periods of 10 and 25 years. These are about 1d/Kw hr for U systems, and Pu power costs are about half those for U^{235}. The power costs are similar for both light and heavy water moderators. (auth)

2503 HW-51008

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

TEMPERATURE COEFFICIENT OF A GRAPHITE-URANIUM LATTICE. R. C. Lloyd and C. R. Richey. June 18, 1957. Decl. Nov. 7, 1957. 29p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

Material buckling measurements were made in a graphite-U exponential pile at temperatures ranging from 24 to 460°C. The large (101-inch cube) exponential pile was loaded with 1.36-inch diameter fuel elements of natural U. The temperature coefficient, over this range is $(1/B_m^2)\,(\Delta B_m^2/\Delta T) = -9.62 \times 10^{-4}$/°C and $(1/k_\infty)\,(\Delta k_\infty/\Delta T) = -4.58 \times 10^{-5}$/°C. Lattice parameters were calculated and the values of $\Delta\eta/\eta$ were determined which permit a fit to the experimental results. (auth)

2504 IDO-16406

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

PARAMETERS OF HIGH FLUX TESTING REACTORS. R. J. Howerton, G. H. Hanson, and W. P. Conner. Aug. 23, 1957. 51p. Contract AT(10-1)-205. $1.50(OTS).

Initially issued July 18, 1957 as PTR-134.

An investigation of thermal fixed-fuel reactors using a cylindrical annulus design with a central experimental facility results in calculated total neutron fluxes, in a gray absorber simulated experiment within the central experimental facility (radius 10 to 15 cm), of 4 to 5×10^{15} n/cm^2 sec with D_2O as coolant, moderator and reflector at an operating power of 400 to 500 Mw. Total neutron fluxes of about one-half these could be obtained using H_2O as coolant, moderator and reflector at a power cost of 300 to 400 Mw. Reducing the fuel concentration results in significantly higher total fluxes but with prohibitively high operating powers. Obtainable fluxes in the simulated experiments have proved to be inversely proportional to the radius of the experimental facility and the wall thickness of the experiment. It is found that thermal fixed-fuel reactors have a built-in upper limit for mean thermal neutron core flux depending upon the two parameters of allowable percentage fuel burnup and minimum allowable cycle time. For the particular case of 40% burnup and 6 day cycle time, the mean value for the time averaged thermal core flux is 1.7×10^{15} n/cm^2 sec. It is noted that a limit exists with circu-

lating fuel reactors with the parameters being allowable operating power and critical mass. (auth)

2505 IDO-16413

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

EXTRAPOLATED CHARGE LIFE FROM INGROWTH OF Xe^{135}. H. L. McMurry and G. A. Cazier. Oct. 2, 1957. 15p. Contract AT(10-1)-205. $0.75(OTS).

Predictions of MTR charge lives are based on the maximum possible life of a completed run. If a run is terminated before its full charge life is realized it is necessary to estimate how long it could have run. Until now this has been done by extrapolating the observed shim rod position vs. Mwd curve to the 30-in. level. Recently data on the change in shim rod level with time after reduction in power to N_L (~0.01 of full power) became available. Equations based on these data were developed for estimating the additional time a charge could run following its termination. (auth)

2506 IGC-TRDC/P-116

United Kingdom Atomic Energy Authority. Industrial Group H. Q., Risley, Lancs, England.

GAS FLOW IN THE MAIN CIRCUITS AND REACTOR CHANNELS. G. Packman and G. H. Inglis. Oct. 11, 1955. 32p. (IGC-TRSWP/R-15).

Design calculations for pressure drops in the ducts and reactor, and for circulator operating points, are set down. The effect of gas flow by-passing the fuel element channels, and of excess gas flow through those channels, is investigated. The method of controlling channel gas flow is discussed, the loss in output for a given degree of flow control is examined in detail, and general conclusions obtained. (auth)

2507 KAPL-1805

Knolls Atomic Power Lab., Schenectady, N. Y.

RADIOGRAPHIC INSPECTION OF S2G REFUELING EQUIPMENT. D. G. Chappell. June 16, 1957. 28p. Contract W-31-109-eng-52. $1.00(OTS).

Data on the radiographic inspection of the Submarine Intermediate Reactor Refueling Machine, Plug Removal Machine, Secondary Safety Transfer Cask, and Reactor Valve Block are presented. No voids were detected in the equipment. The radiographic inspection was carried out with a 12-curie Co^{60} source and a multi-area probe. Count rate scaling factors for estimating void size and void geometry were prepared from data obtained from a series of known voids. (auth)

2508 KAPL-M-FCM-1

Knolls Atomic Power Lab., Schenectady, N. Y.

LONG TERM REACTIVITY CHANGES IN MEDIUM ENRICHMENT REACTORS. F. C. Merriman. July 15, 1957. 35p. Contract W-31-109-eng-52. $6.30(ph OTS); $3.00 (mf OTS).

The Pu production rate and reduction in reactivity changes with life during reasonable long running periods are investigated for medium enrichment reactors. (auth)

2509 KAPL-M-SMS-19

Knolls Atomic Power Lab., Schenectady, N. Y.

EXPERIMENTAL EXTREME WATER CONDITIONS FOR MECHANISM AND COMPONENT TESTING. A. A. Sugalski. Mar. 9, 1956. 7p. S3G/S4G Project. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

The O_2 concentrations and water conditions resulting from filling at sea, the approximate length of time that these conditions can be expected to be maintained in the primary system, and the methods by which these water conditions can be obtained in out-of-pile test loops are discussed. (W.L.H.)

2510 KAPL-M-SMS-31

Knolls Atomic Power Lab., Schenectady, N. Y.

CONTROL OF GASES IN PRIMARY COOLANT DURING FILLING AND COLD PLANT STARTUP. G. H. Epstein. July 6, 1956. Includes Appendices I and II. 30p. Contract [W-31-109-Eng-52]. $4.80(ph OTS); $2.70(mf OTS).

Estimates are presented of the amounts of gases which will be trapped in the S3G/S4G reactor plant for several conditions of cold plant startup. General procedures to be followed during plant filling and warmup to reduce the amounts of gases remaining in the plant after startup are outlined. Specific control measures for each of the several modes of cold plant startup are given. (W.L.H.)

2511 KAPL-M-SMS-42 and Suppl.

Knolls Atomic Power Lab., Schenectady, N. Y.

FACTORS INFLUENCING THE SELECTION AND PERFORMANCE OF THE DEAERATING FEED LINE DEMINERALIZER RESIN. G. H. Epstein. Oct. 4, 1956. 14p. Includes Supplement: PROOF-TEST OF DEAERATING FEED LINE DEMINERALIZER. [Oct. 9, 1956.] 6p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

To prevent the entry of Ar and O_2 into the main coolant system, an adjunct to the S3G/S4G Main Coolant Charging System has been designed to permit the use of deaerated condensate from the secondary system for filling and make-up to the main coolant system. A deaerating feed tank in the secondary system will provide the means of deaeration. The deaerated condensate from the DFT is tapped from the discharge of the feed booster pump at a pressure of 80 psia, is cooled and then purified by passage through a small demineralizer, which is located in the deaerated feed charging line downstream of the DFT. This report discusses the service conditions under which the demineralizer will operate and the expected performance of the ion exchange resin under these conditions. (auth)

2512 KAPL-M-SMS-80

Knolls Atomic Power Lab., Schenectady, N. Y.

A STRUCTURAL EVALUATION OF THE S3G/S4G STEAM GENERATOR DESIGN FOR HYDROSTATIC TEST. J. C. Westmoreland. [Oct. 7, 1957]. 35p. Contract W-31-109-eng-52. $6.30(ph OTS); $3.00(mf OTS).

A structural evaluation of the Submarine Advanced Reactor steam generator design has been made. Calculated strain values are reported at various points on the structure for hydrostatic test of both the primary and secondary side. Experimental strain gauge measurements were obtained during hydrostatic test of the No. 1 unit by the vendor, and a comparison of these data with the predicted results is presented. The average deviation of the predicted strains from the experimental strains was found to be + 15%, and in all cases, the estimation of strains was high. The theoretical representation of the structure is judged satisfactory on the basis of the predicted response to pressure loadings, and hence may be employed with the same degree of certainty in predicting strains for loads imposed by conditions of temperature, mechanical shock, and fatigue. (auth)

2513 KAPL-M-SMS-82

Knolls Atomic Power Lab., Schenectady, N. Y.

COMPARISON OF METHODS FOR BOILER WATER CHLORIDE REMOVAL FOR THE S3G/S4G PLANT. E. J. Placzkowski. Oct. 11, 1957. 66p. Contract W-31-109-eng-52. $10.80(ph OTS); $3.90(mf OTS).

Several methods of boiler water chloride removal are compared. These methods can be divided into two general classifications, viz., batch and continuous. In considering batch methods the following operating conditions are assumed: (1) The concentration of chloride ion in the boiler water has increased to a relatively high value (e.g.,

5 ppm) due to the inleakage of sea water into the condensate system; (2) The leakage into the condensate system has been stopped by taking the defective condenser "off the line"; and (3) The batch methods are then used to decrease the boiler water chloride concentration from a high value (5 ppm) to a normal level (<0.5 ppm). The following batch methods were evaluated for a boiler water chloride decrease from 5 ppm to 0.4 ppm: a series of steam generating system blowdowns and subsequent makeup water additions, and deionization of boiler water. Continuous methods were evaluated on the assumption that the steam generating system was operated normally with an inleakage of chloride. The defective condenser is not secured. Continuous blowdown of the steam generating system, continuous deionization of the boiler water, and continuous full flow deionization of the condensate were considered. In an attempt to effect high temperature chloride removal several tests were run using a silver form resin. (auth)

2514 KAPL-M-WES-1

Knolls Atomic Power Lab., Schenectady, N. Y.

THE USE OF B_4C FOR REACTOR CONTROL. W. K. Barney, G. A. Sebmal, and W. E. Seymour. Oct. 15, 1957. 24p. Contract W-31-109-eng-52. $4.80(ph OTS); $2.70 (mf OTS).

The use of B_4C for the control of a sodium-cooled reactor is considered from a design standpoint. Nuclear, mechanical, and physical properties as well as irradiation data are presented. The ability of the B_4C lattice structure to retain helium produced from the neutron capture of B^{10} is discussed. (auth)

2515 LMFS/P-1

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

CIRCULATING LIQUID METAL FUEL REACTORS. (ENGINEERING STUDIES ON A URANIUM–BISMUTH–THORIUM SYSTEM). W. Murgatroud, ed. July 25, 1956. 81p.

The results of a study of some of the engineering aspects of a graphite moderated, U–Bi solution fuelled reactor of the circulating fuel type are reported. Critical size calculations were carried out chiefly with the object of setting the scale of a core design and of specifying the materials allowed in the core structure. The calculations suggest that provided a core can be constructed without the significant use of steel, or its equivalent in neutron capturing material, conversion factors of 1 plus should be obtainable. Examination of approximations to the kinetic equations reveals conditions under which instability could occur. Some possible methods of plant control are discussed. It is not certain that control rods can be dispensed with. It is concluded that an intermediate liquid metal coolant is desirable and at present Bi and Pb–Bi is favored for this purpose. There is a great need for data to enable compact piping and heat exchangers to be designed. There is no evidence that the fuel can be pumped reliably on the scale required. It is stressed that this type reactor could not be designed at present. The emphasis at present should be on the U–Bi fuel technologies. (M.H.R.)

2516 LMFS/P-9

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

GENERALIZED ALBEDO CONCEPTS IN TWO-GROUP MULTI-REGION REACTOR PROBLEMS. J. J. Thompson. Dec. 17, 1956. 17p.

The general principles of a method for the accurate or approximate analysis of the two group reactor problem are described. The assembly is split into simpler sub-systems and the critical equation derived by matrix methods in terms of albedo or flux matrices which describe the properties of the sub-regions. The calculation of the elements of these matrices is described for some configurations of frequent occurrence. (auth)

2517 NDA-84-2

Nuclear Development Corp. of America, White Plains, N. Y.

SDR PROJECT QUARTERLY TECHNICAL PROGRESS REPORT FOR THE PERIOD MAY 1, 1957 THROUGH JULY 31, 1957. Sept. 30, 1957. 54p. Contract AT(30-3)-256. $9.30(ph OTS); $3.60(mf OTS).

Engineering studies were made and experimental work was carried out with the objective of demonstrating the feasibility of separation of Na and D_2O in the SDR reactor. For the engineering studies, a through-tube reactor design was selected. Layouts of fuel-coolant tube and header arrangements were made with a view towards minimizing the probability of mechanical failures of these sodium system components. Preliminary studies on Na and D_2O system requirements and on the design of the D_2O moderator tank or calandria were started. A survey was made of possible barrier materials, i.e., materials which may be located between the fuel-coolant tubes and the calandria tubes to minimize the consequences of single or multiple-tube failures. Mechanical arrangements for mounting and supporting barrier materials and for detecting leaks were investigated. Conceptual designs of equipment for testing the mechanical integrity of fuel-coolant tube and header joints were completed. Major components of a single-failure rig, in which barrier materials can be subjected to Na streams that simulate Na system failures, were designed, constructed, and assembled. Preliminary design of a multiple-failure test apparatus, in which the effects of both Na and D_2O failures will be investigated, has been completed. Preliminary design of a mockup test apparatus has been finished; this apparatus, which will be a full scale representation of a section of the reactor, will be used to demonstrate the reliability of integrated Na and H_2O circulating systems under simulated normal and aggravated reactor operating conditions. The shielding problems associated with radiation limitations on access to header rooms for repairs and maintenance were evaluated. Temperatures, pressures, and flow rates for the secondary Na and steam systems were established. (auth)

2518 NPCC/RPWP/P-17

Gt. Brit. United Kingdom Atomic Energy Authority. Industrial Group H. Q., Risley, Lancs, England.

CONVENTIONS FOR FLUXES AND CROSS-SECTIONS FOR PIPPA CALCULATIONS. B. Cutts, R. R. Gallie, and P. W. Mummary. May 1956. 4p.

The existing recommendations for conventions for PIPPA calculations are recapitulated, together with the assumptions regarding the neutron spectrum. These recommendations are not entirely consistent. The correlation of fundamental and various integral data has required different assumptions. No change to the Westcott convention is recommended as yet for PIPPA calculations. (M.H.R.)

2519 NPCC/RPWP/P-59

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE VARIATION OF NEUTRON FLUX WITH SEPARATION OF URANIUM RODS IN A CHANNEL OF A LATTICE. S, S. Stone and K. G. Greenhouse. June 18, 1957. 10p.

The neutron flux distribution between the ends of two U rods separated by 6 and ½ in. was measured experimentally for rods of a single channel of a lattice. For both separations the experiments were performed with air and then Al filling the gap between the rods. The series of

measurements was performed for two coolant channel sizes. (auth)

2520 NURG/M-11

[Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.]

URANIUM DEPLETION, PLUTONIUM BUILD-UP AND LONG TERM CHANGES IN REACTIVITY IN A NATURAL URANIUM POWER REACTOR. J. F. Hill. Jan. 15, 1952. 5p.

2521 NURG/M-25

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

TECHNICAL DESIGN FOR A NATURAL URANIUM POWER REACTOR. PART II. HEAT TRANSFER AND PRESSURE DROP CHARACTERISTICS FOR NATURAL URANIUM POWER REACTOR. G. Packman. Mar. 31, 1952. 18p.

Previous work on this subject considered the effect of channel geometry, coolant gas, and canning material on heat transfer and pressure drop in an individual channel in a natural U, graphite moderated, pile when the slugs in that channel were reacting to produce heat at a fixed rate. Here that order has been reversed, the geometry, coolant, and canning material have been kept constant and the effect of channel heat output on heat transfer and pressure drop has been investigated. (auth)

2522 NURG/M-57

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE EFFECT OF RE-ENTRANT COOLING ON THE ATTAINABLE TEMPERATURE RISE RATIO IN GAS-COOLED REACTORS OF THE PIPPA TYPE. J. H. Bowen. Apr. 14, 1953. 10p.

2523 NURG/M-59

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

EFFECT OF GRAPHITE TEMPERATURE ON POWER SENT OUT BY PIPPA. J. H. Bowen. May 12, 1953. 14p.

2524 POC-Data-51/A

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

MK I URANYL SULPHATE LOOP IN BEPO DESIGN MANUAL (REVISION A). I. Everson and H. G. Lyall. July 1957. 45p.

A description of the loop together with details of loop operation, taking of samples, instrumentation, and safety circuitry is presented. Reference is made to operational hazards and relevant precautions. Attached appendices cover cleaning, welding, inspection, special design, and safety aspects and include a summary of principal calculations. (auth)

2525 WAPD-PWR-973

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

DEVELOPMENT OF SHIPPINGPORT ATOMIC POWER STATION OPERATING PROCEDURES. Reuel F. Stratton. May 1957. 44p. Contract AT-11-1-GEN-14. $1.25(OTS).

Supplemental to WAPD-SC-541.

2526 WAPD-BT-4

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

THE BETTIS TECHNICAL REVIEW, VOL. 1, NO. 4; REACTOR PHYSICS AND MATHEMATICS. Oct. 1957. 118p. Contract AT-11-1-GEN-14. $3.25(OTS).

Discussions included on reactor theory and experimentation are a review of methods used in control rod analysis for reactor design at Bettis Plant, two-dimensional burnup of a cell, resonance capture in heterogeneous systems, half-height Cd slab, synthesis of three-dimensional power distributions for a nonuniformly depleted core, synthesis of three-dimensional power shapes—flux-weighting technique, nuclear design of a fuel assembly for an irradiation proof test, analysis of a heterogeneous critical assembly, the use of the equivalent bare core model for calculating the criticality of slab-type reactors and a comparison to experiment, thermal flux depressions in materials containing fuel and B, an inverted reactivity effect, thermal equivalent Σ_p for Cd—Ag control rods, changes in reactivity produced by thermal expansion of extruded polyethylene fuel tape, and construction and operation of a miniature fission counter. Topics on mathematics and computation are a lemma of Stieltjes, a calculation of thermal constants, reactor criticality and non-negative matrices, a steady-state thermal analysis code for the IBM-704 computer, few-group fitted parameters, a new version of the multigroup Fourier Transform code for calculation of fast group parameters, the WANDA spatial code, and CANDLE—a one-dimensional few-group lifetime depletion code. (M.H.R.)

2527 WAPD-PWR-970

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

DESCRIPTION OF THE SHIPPINGPORT ATOMIC POWER STATION. June 1957. 146p. Contract AT-11-1-GEN-14. $3.75(OTS).

Supplemental to WAPD-SC-541.

2528 WAPD-PWR-974

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

PRESSURE VESSEL AND PIPING CODES APPLICABLE TO THE PWR REACTOR PLANT. J. F. Dobinsky, M. B. Andrew, and T. R. Moffette. May 1957. 16p. Contract AT-11-1-GEN-14. $0.50(OTS).

Supplemental to WAPD-SC-541.

State, Government, and ASME Codes are given for the radiation exposure, waste disposal, piping, and pressure vessels for the PWR reactor plant. (W.L.H.)

2529 WAPD-PWR-PCR-327

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

[RE]: DELAYED NEUTRON MONITOR FOR USE WITH THE FAILED ELEMENT DETECTION AND LOCATION SYSTEM—PWR PROJECT, CONTRACT AT-11-1-GEN-14—SUBCONTRACT 73-(14-498). Feb. 12, 1957. W. R. Ellis. 8p. $1.80(ph OTS); $1.80(mf OTS).

An evaluation of four delayed neutron monitor designs for use with the failed element detection and location system for the PWR is presented. (W.L.H.)

2530 WAPD-SC-541

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

PWR HAZARDS SUMMARY REPORT. Sept. 1957. 135p. Contract AT-11-1-GEN-14. $3.75(OTS).

Supplementary reports issued as WAPD-SC-542 through WAPD-SC-549; WAPD-PWR-970 through WAPD-PWR-974; and DL-S-191.

Results are presented from an evaluation of the off-site radiation hazards associated with the Pressurized Water Reactor (PWR) Plant located at Shippingport, Pennsylvania. Analyses were made of the radiological hazards that might result from the major types of accidents that must be considered in a pressurized water reactor plant. An explanation is included of how the plant is protected against each type of accident. To provide the necessary background and supporting information for the accident and hazard discussion, fourteen supplementary reports were prepared. They were printed as separate documents and cover plant and site descriptions, including meteorology of the site; details of the calculations summarized herein; and other supplementary information. The list of supplementary documents referred to in this report is included. (C.H.)

2531 WAPD-SC-544

Westinghouse Electric Corp. Bettis Plant, Pittsburgh and Battelle Memorial Inst., Columbus, Ohio.

PWR LOSS-OF-COOLANT ACCIDENT CORE MELTDOWN CALCULATIONS. L. M. Swartz, A. W. Lemmon, Jr., and L. E. Hulbert. May 1957. 86p. Contract AT-11-1-GEN-14. $2.25(OTS).

Supplemental to WAPD-SC-541.

Results are presented of a study made of the possible extent of zirconium-water reaction and core meltdown following a postulated loss-of-coolant accident in the PWR plant. Zirconium-water chemical reaction and core meltdown occur in the course of the core temperature excursion which could follow a loss-of-coolant if no cooling were provided after an uncovering of the core. An analysis of the temperature excursion involves consideration of the complex relationships between core geometry, decay heating rates, water (or steam) flow through the core, and the thermodynamic and chemical properties of water, steam, and the core materials. Parametric studies of the temperature excursion are used in evaluating the effectiveness of the PWR Safety Injection System in prevention of core chemical reaction and meltdown. Combinations of delay time in operation and rate of injection are considered. (auth)

2532 WAPD-SC-542

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

PWR REACTIVITY ACCIDENTS. D. H. Jones and M. J. Galper. Oct. 1957. 25p. Contract AT-11-1-GEN-14. $1.00(OTS).

Supplemental to WAPD-SC-541.

The reactivity accidents of consequence to the PWR can arise either from improper motion of the control rods or from the sudden introduction into the core of cold water. (W.L.H.)

2533 WAPD-SC-546

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

SAFEGUARDS ASPECTS OF PWR REACTOR COOLANT CHEMISTRY. W. T. Lindsay. [June 1957]. 23p. Contract AT-11-1-GEN-14. $0.75(OTS).

Supplemental to WAPD-SC-541.

In the Pressurized Water Reactor (PWR) light water serves as both moderator and as coolant. The water at the same time participates in a variety of chemical process of concern in the design and operation of the reactor. These include corrosion of the primary coolant system, mechanisms, and fuel elements; radiation chemical reactions involving dissociation and synthesis; nuclear reactions and induced radioactivity; transport and fouling due to formation of plant corrosion products, and fuel element failure and release of fission products. Each of these processes involves potentially undesirable consequences for pressurized water reactors. In the development of PWR in particular, and pressurized water reactors in general, these processes have been examined, and water conditions and plant systems have been developed to reduce the extent and consequences of these processes to acceptable levels. The considerations involved in normal plant operation, with normal water conditions are discussed first. Secondly, the results of possible temporary variations from the desired mode of operation are considered in terms of their effect on plant safety. Some of the water conditions which may result from improper operation can have undesirable effects, such as increased general corrosion, causing accelerated fouling of heat transfer surfaces or decreased accessibility resulting from radioactive contamination of plant internal surfaces. However, no plausible deviation from the normal water conditions will have immediate undesirable effects, with the result that temporary excursions from the desired set of conditions may be tolerated for the period of time required for detection of the deviation and correction to the desired conditions. Nevertheless, since corrosion, fouling and contamination are cumulative processes, every effort is made to reduce to a minimum the period during which the plant may be operating with water conditions other than normal. The consequences of fuel element failure are discussed. It is shown that operational limitations will not arise which can deny access if as many as 1000 blanket fuel rods contain defects in the cladding. (auth)

2534 WAPD-SC-547

Duquesne Light Co., Shippingport, Penna.; Weather Bureau, [Washington, D. C.]; and Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

DESCRIPTION OF SHIPPINGPORT ATOMIC POWER STATION SITE AND SURROUNDING AREA WITH RADIATION BACKGROUND AND METEOROLOGICAL DATA. R. J. McAllister, W. B. Wirth, and T. B. Harris, Jr. 39p. Contract AT-11-1-GEN-14. $1.00(OTS).

Supplemental to WAPD-SC-541.

The Shippingport Atomic Power Station site and the surrounding area is described. The geographical, population, industrial, geological, hydrological, radiation background and meteorological aspects of the site and surrounding area are discussed. (auth)

2535 WAPD-SC-549

Stone and Webster Engineering Corp., [Boston] and Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

PWR PLANT CONTAINER SIZING CRITERIA. STUDIES OF TRANSIENT TEMPERATURE AND PRESSURE IN PLANT CONTAINER FOLLOWING PRIMARY COOLANT SYSTEM RUPTURE. R. M. Rome and T. R. Moffette. June 1957. 38p. Contract AT-11-1-GEN-14. $1.00(OTS).

Supplemental to WAPD-SC-541.

2536 YAEC-35

Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.

QUARTERLY PROGRESS REPORT FOR THE PERIOD MARCH 16, 1957 TO JUNE 30, 1957. I. H. Coen and R. A. Birkel. July 30, 1957. 59p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. $9.30 (ph OTS); $3.60(mf OTS).

Work was continued toward the development of a satisfactory stainless steel clad UO_2 fuel element. Included in this work were studies of UO_2 pellet fabrication and properties, clad end welding, and rod stability. Studies and calculations on core design optimization, kinetic and steady state reactor analysis, shielding, and reactor startup and operation were continued. Additional critical and irradiation experiments were planned. Progress in reactor mechanical, hydraulic, and thermal design is reviewed. Information on control rod materials include corrosion studies of Cd–In–Ag alloy and fabrication experience with stainless steel–Ag–B_4C. Coolant water temperature transient studies were made on the APD analog simulator. (For preceding period see YAEC-20.) (D.E.B.)

2537

ORGANIC MODERATED AND COOLED REACTORS. Henri Polak (North American Aviation, Inc., Canoga Park, Calif.). Atomkern Energie 2, 390-6(1957) Oct.

2538

HEAT TRANSFER COEFFICIENT IN HOMOGENEOUS REACTORS WITH INTERNAL HEAT EXCHANGERS. J. Klauss and K. H. Höcker. Atomkern Energie 2, 397-400(1957) Oct. (In German)

2539
STATUS OF TECHNOLOGY IN NUCLEAR ENERGY. A. Sejc. Jaderna Energie. 2, 298-308(1956). (In Czech)

A report presented at the Electric Power Conference in Vienna, 1956, is discussed. A review is given of nuclear power plants, reactor construction, reactor fuel materials, sources and availability, and other aspects in applications of nuclear energy in industry. (R.V.J.)

2540
HINKLEY POINT, THE WORLD'S BIGGEST NUCLEAR POWER STATION. Nuclear Power 2, 450-4(1957) Nov.

The layout of the Hinkley Point nuclear power station and the design of the reactors for this station are given. (W.L.H.)

2541
POWER STATION INSTRUMENTATION. J. C. Nutter and J. Dowsing (Elliott Brothers, Ltd., London). Nuclear Power 2, 455-62(1957) Nov.

The design of instrumentation for a gas-cooled plant is given. Schematic diagrams are presented of major reactor and steam generator instrumentation. (W.L.H.)

2542
THE ORGANIC LIQUID MODERATED REACTOR. H. W. Bowker (A.E.R.E., Harwell). Nuclear Power 2, 473-7 (1957) Nov.

The advantages, disadvantages, preferred organic liquid, uses, radiation effects, and cost factors of an organic liquid moderated reactor are discussed. (W.L.H.)

2543
ROLE OF THE FAST POWER REACTOR IN DEVELOPMENTS OF NUCLEAR ENERGY. Mieczystaw Taube. Nucleonika 2, No. 1, 9-30(1957). (In Polish)

The economic potentials of nuclear energy in electrical power production are analyzed. The commercial aspects of U and Pu fuels are evaluated, and the distribution and supply of nuclear and conventional fuels in the world are estimated. (R.V.J.)

Nuclear Transformation

2544
GAMMA RAYS FROM THE REACTIONS $F^{19}(p,\alpha\gamma)O^{16}$, $Be^{9}(d,p\gamma)Be^{10}$, $Be^{9}(d,n\gamma)B^{10}$, $B^{10}(p,p'\gamma)B^{10}$, AND $B^{11}(p,p'\gamma)B^{11}$. J. H. McCrary, T. W. Bonner, and W. A. Ranken (Rice Inst., Houston, Texas). Phys. Rev. 108, 392-7(1957) Oct. 15.

The Rice Institute magnetic-lens pair spectrometer has been used to detect γ radiation from the $F^{19}(p,\alpha)O^{16*}$ reaction. The γ-ray transition from the 8.88-Mev level in O^{16} to the ground state and the cascade γ from this level to the 6.13-Mev state have been observed. Relative intensities of these γ rays and the 7.12-Mev γ ray are given. Gamma-ray spectra from Be^{9} + d were observed at 1.5-, 2.0-, 3.2-, and 4.0-Mev deuteron energies. Relative intensities of the 2.90-, 3.38-, 4.45-, and 5.99-Mev γ radiation were determined. Excitation curves were obtained for the 3.38- and 5.99-Mev γ rays from Be^{10*} between deuteron energies of 1.0 and 5.6 Mev. The relative intensities of the 3.58- and 2.86-Mev radiations from the 3.58-Mev level in B^{10*} were measured using the $B^{10}(p,p')B^{10*}$ reaction. Other γ radiation with energies of 0.43 Mev from $B^{10}(p,\alpha)B^{7*}$, 0.72, 1.023, and 1.438 Mev from $B^{10}(p,p')B^{10*}$, and 2.134 Mev from $B^{11}(p,p')B^{11*}$ was observed. (auth)

2545
ON THE THEORY OF THE STRIPPING REACTION. A. C. Sitenko (Academy of Sciences, Ukrainian SSR). Soviet Phys. JETP 4, 492-6(1957) May.

A simple derivation of the Butler formula for the angular distribution in the (d, p) reaction is presented. The scattering of the deuteron and proton waves in the nuclear field is included. The examined theory leads to Serber's results in the limiting case of large energies for the impinging deuterons. (auth)

2546
INVESTIGATION OF THE $Be^{9}(dn)B^{10}$ NUCLEAR REACTION. V. I. Mamsakhlisov (Academy of Sciences, Georgian SSR). Soviet Phys. JETP 4, 520-4(1957) May.

An investigation is carried out on the reaction between the nucleus of Be and a deuteron in which the latter is captured by the nucleus and the unpaired neutron is ejected. The effective cross section of the process and the angular distribution of the freed neutrons were found. The comparison of the angular distribution with experimental data results in a satisfactory agreement for small angles up to 70°. (auth)

2547
EXCITATION FUNCTION FOR THE $Si^{28}(d, p)Si^{29}$ REACTION. Iu. A. Nemilov and V. F. Litvin. Soviet Phys. JETP 4, 606-7(1957) May.

The yields of various groups of protons from the $Si^{28}(d,p)Si^{29}$ reaction were investigated, as functions of the fixed detector angle and the primary deuteron energy. Spectra of protons were obtained at an angle $\theta = 109°$ with the direction of motion of the primary particles for 15 values of deuteron energy ranging from 1.75 to 4.75 Mev. (M.H.R.)

Particle Accelerators

2548 LWS-24700
California Research and Development Co., Livermore, Calif.
PRODUCTION IN A PEBBLE TYPE LATTICE. F. E. Bjorklund. Jan. 9, 1953. Decl. Sept. 27, 1957. 9p. (CRD-R-47). $1.80(ph OTS); $1.80(mf OTS).

It is possible that fuel handling in the MTA lattice could be greatly simplified by the use of spheres rather than rods or slabs. For this reason some of the properties of such a lattice have been investigated. Pu production and the number of fissions per neutron incident on the lattice have been calculated as functions of the fuel radius and porosity of the bed. The number of fissions may be used to calculate the heat load in the lattice and the production may be used to make an economic comparison between this and other proposed lattice geometrics. The original plan was to use a containing vessel into which the fuel spheres could be poured. This would lead to a bed in which the porosity varied locally from 27 to 47.5% with an average of 38%. For this reason calculations were carried out for lattices with 27, 38, and 47.5% voids. The lattice considered uses U depleted to 0.3%, 25 as fuel. The cladding is 0.05 cm of Al and the moderator is H_2O. A comparison was made between the base case rod lattice and a pebble lattice consisting of fuel spheres 5 cm in diameter. Equations used in calculating lattice parameters are presented. (auth)

2549 MURA-373
Midwestern Universities Research Assn., Madison, Wis.
DESIGN OF A 50 MEV ELECTRON RADIAL SECTOR FFAG ACCELERATOR. F. T. Cole and A. M. Sessler. Nov. 4, 1957. 36p. Contract AT(11-1)-384. $6.30(ph OTS); $3.00(mf OTS).

Design considerations and methods used to design a 50 Mev electron radial sector FFAG accelerator are described. Results are given for stability limits and effects of misalignments for various parameters. Design of the magnets to produce the desired field shape is discussed. (auth)

2550 UCRL-3907

California. Univ., Berkeley. Radiation Lab.

AN ANALYTICAL METHOD FOR CORRECTING THE MAGNETIC FIELD OF A CYCLOTRON. James A. Baker and Warren Fenton Stubbins. Aug. 19, 1957. 22p. Contract W-7405-eng-48. $0.75(OTS).

A computational procedure has been devised to give the shim changes required to correct the magnetic field of the 184-inch cyclotron, thus avoiding the empirical shimming formerly used. A mathematical model of the shim element suggested by Lambertson's study of the effect of small volumes of Fe on the pole faces of magnets was used. The magnetic field is described by stating its value on the median plane above the 240 shim-element centers. A mapping function, calculated from the induced dipoles and their images, which gives the effect on the magnetic field in the median plane for a unit change in the height of each of 240 shim elements was computed. The effect of each shim-element change in the 23,000-gauss field is determined for all centers. Two hundred forty simultaneous equations are solved by an iterative process to find the necessary shim-element changes. Those calculated for a large measured field change corresponded to the ones producing the change in the 184-inch model magnet. The application of this method to shimming the 184-inch cyclotron will be reported. (auth)

2551 AEC-tr-3021

ON A METHOD OF INCREASING THE DENSITY OF AN EXTERNAL PROTON BEAM FROM THE SIX-METER SYNCHROCYCLOTRON. V. I. Danilov, V. P. Dmitrievskii (Dmitrievsky), and I. V. Chestnoi. Translated from Pribory i Tekh. Eksperimenta, No. 3, 9-(?)(1956). 11p.

The estimation of increasing the average density was performed by comparing the cross sections of the external beam in the absence or presence of the focusing magnetic field. The calculation of the focusing effect of the magnetic field was made on the basis of the analysis of particle motion along the beam trajectory. The focusing field was created in the non-working region of the accelerator's magnetic field with the help of iron masses of certain configurations. (M.H.R.)

2552

INVESTIGATIONS OF THE ENERGY SPECTRA OF PROTONS IN THE INNER BEAM OF A PHASOTRON. Yu. D. Prokoshkin. Joint Institute of Nuclear Research. Laboratory of Nuclear Problems. 1956. (In Russian)

Experiments were made to determine the amplitude of free radial oscillations by measuring the energy of proton beam collisions with the filaments placed in a phasotron (synchrocyclotron) at various distances. The design of the accelerator, trochoids of radial motions of particles, and distribution of the inner beam protons according to their amplitudes and energies are given. (R.V.J.)

2553

HIGH-CURRENT GAS TARGET. Ralph Nobles (Los Alamos Scientific Lab., N. Mex.). Rev. Sci. Instr. 28, 962-3 (1957) Nov.

The limitation on neutron flux obtainable from accelerators using gas targets is usually imposed by the rate at which heat can be dissipated by the entrance window of the gas chamber. It is shown that this situation can be improved if the window is cooled by a stream of gas. A standard Los Alamos gas target was modified so that the entrance window consists of two closely spaced foils which are cooled by a stream of hydrogen gas passing between them. This modified target produces neutron fluxes 10 to 50 times larger than had previously been possible. (A.C.)

2554

HIGH-VOLTAGE RHEOSTAT FOR ELECTROSTATIC ACCELERATOR FOCUSING. B. D. Kern, L. W. Cochran, and K. A. Schneider (Univ. of Kentucky, Lexington) and T. M. Hahn, Jr. (Virginia Polytechnic Inst., Blacksburg). Rev. Sci. Instr. 28, 969(1957) Nov.

A high-voltage rheostat which is used to control part of the total terminal voltage for focusing purposes is described. This device has proven highly satisfactory on Van de Graaff generators. (A.C.)

2555

OPERATION OF A SPIRAL SECTOR FIXED FIELD ALTERNATING GRADIENT ACCELERATOR. D. W. Kerst, H. J. Hausman, R. O. Haxby, L. J. Laslett, F. E. Mills, T. Ohkawa, F. L. Peterson, A. M. Sessler, J. N. Snyder, and W. A. Wallenmeyer (Midwestern Universities Research Assn., Madison, Wis.). Rev. Sci. Instr. 28, 970-1(1957) Nov.

A successfully operating spiral sector accelerator is described in which the magnetic field is unidirectional, and alternation of the gradient is achieved by the edge focusing of the spiral sectors. (A.C.)

Radiation Absorption and Scattering

2556 CRT-712

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

NEUTRON CAPTURE BY LONG CYLINDRICAL BODIES SURROUNDED BY PREDOMINANTLY SCATTERING MEDIA. S. A. Kushneriuk. June 1957. 58p. (AECL-462)

Calculations of the boundary condition, ratio of the true surface flux to the average flux in the cylinder, ratio of the diffusion approximation flux to the surface flux, and the blackness are reported. An investigation of blackness and its relation to neutron self-shielding is also given. (D.E.B.)

2557

DIRECT INTERACTION THEORY OF INELASTIC SCATTERING. PART I. Carl A. Levinson and Manoj K. Banerjee (Princeton Univ., N. J.). Annals of Physics 2, 471-98(1957) Nov.

In this paper the direct interaction theory of inelastic scattering of nucleons on nuclei is developed. The method of distorted waves is required since the plane wave approximation for the projectile is not sufficient for a detailed analysis of these processes. Several interesting selection rules are derived and comparison of these rules with experiments are presented. In particular, it is shown how information about level spins in nuclei can be derived from inelastic scattering experiments. (auth)

2558

DIRECT INTERACTION THEORY OF INELASTIC SCATTERING. PART II. ANGULAR CORRELATION OF GAMMA RAYS FOLLOWING INELASTIC SCATTERING. Manoj K. Banerjee and Carl A. Levinson (Princeton Univ., N. J.). Annals of Physics 2, 499-524(1957) Nov.

The angular correlation function of the gamma rays, following inelastic scattering of protons via direct interaction, has been calculated. The effects of the distortions of the plane waves on the angular correlation have been discussed. It has been shown that the angular correlation function depends on the spin exchange process and thus on the nuclear wave function. Analyzing the experimental data on $C^{12}(p,p')C^{12*}\gamma C^{12}$ angular correlation, it was found that the wave functions describing the ground and the first excited state of C^{12} must be very close to the extreme j-j coupling limit. (auth)

2559

DETERMINATION OF γ-RADIATION INTENSITY IN VOLUME RADIOACTIVE SOURCES CONSIDERING THE EFFECTS OF SCATTERING. A. A. Korzhev (All-Union Research Inst. of Geophysical Methods of Prospecting in the Oil Industry). Izvest. Akad. Nauk S.S.S.R. Ser. Geofiz. 1189-93(1957) Sept. (In Russian)

Expressions are developed for the γ-ray intensity at the boundary of two media considering single and multiple scattering. The general expression of the heterogeneous spectrum for γ radiation from a volume radioactive source is developed. (R.V.J.)

2560

FOCUSING IN COLLISION PROBLEMS IN SOLIDS. R. H. Silsbee (Oak Ridge National Lab., Tenn.). J. Appl. Phys. 28, 1246-50(1957) Nov.

In treating problems of sputtering and radiation damage of solids, a billiard ball model is frequently assumed. An attmept is made to indicate to what extent such a model is justified. Using this model it is noted that the lattice structure of a crystal implies a correlation between successive collisions in a damage process which can lead to the propagation of an energy pulse, or a sequence of collisions, along a close-packed line of atoms. The rate of attenuation of these pulses is estimated for a particular case and certain implications of the effect are discussed. (auth)

2561

NOTE ON THE ELASTIC SCATTERING OF HIGH-ENERGY PARTICLES. L. I. Schiff (Stanford Univ., Calif.). Nuclear Phys. 4, 632-3(1957) Oct.

This note is in answer to a communication by I. M. Khalatnikov (Nuclear Phys. 3, 433(1957)) which asserted that the large-angle scattering formula derived by the author (Phys. Rev. 103, 433(1956)) is incorrect. (L.T.W.)

2562

π^--p ELASTIC SCATTERING AT 1.44 Bev. M. Chretien, J. Leitner, N. P. Samios, M. Schwartz, and J. Steinberger (Columbia Univ., New York). Phys. Rev. 108, 393-9(1957) Oct. 15.

An investigation of π^- + p elastic scattering, made in a liquid propane bubble chamber, is reported. Identification of events is made on the basis of kinematics. The problem of contamination by pion scattering from protons bound in carbon is considered in some detail; it is shown that the latter requires a correction of only 4 ± 2.5% of the total number of events. The angular distribution is presented. It shows a large diffraction peak at small angles and an approximately isotropic plateau over the backward hemisphere. The forward peak is fitted to a black-sphere diffraction pattern with a radius of $(1.08 \pm 0.06) \times 10^{-13}$ cm. The total elastic cross section is found to be $\sigma_e = 10.1 \pm 0.80$ mb. (auth)

2563

ELASTIC SCATTERING OF 96-Mev PROTONS. G. Gerstein, J. Niederer, and K. Strauch (Harvard Univ., Cambridge, Mass.). Phys. Rev. 108, 427-32(1957) Oct. 15.

The elastic scattering of 96-Mev protons from C, Al, Cu, Ag, Ta, Pb, and Th has been investigated at laboratory angles between 3° and 60°. A range telescope with an overall energy resolution of 2.8 Mev was used to obtain the energy distribution of scattered protons at each angle of observation. The energy distributions are analyzed to obtain values for (1) an "upper limit" to the elastic cross section which includes slightly inelastic events, and (2) an "extrapolated" elastic cross section in which inelastic events are subtracted by an extrapolation procedure. All targets show diffraction minima and Coulomb-nuclear interference effects. The depth of the diffraction minima in general increases with atomic number, except that Ta and Th have less pronounced minima than either Ag or Pb. (auth)

2564

DIRECTION OF POLARIZATION PRODUCED BY QUASI-ELASTIC SCATTERING OF 315-Mev PROTONS. Hugh Bradner and William Isbell (Univ. of California, Berkeley). Phys. Rev. 108, 463-5(1957) Oct. 15.

Protons scattered quasi-elastically with energy 315 Mev at 13° from a beryllium target in the Berkeley synchrocyclotron were brought out of the machine, slowed by absorbers, and scattered in helium at 765 psi absolute pressure. Scattering events at angles of 90° ± 22.5° were detected in nuclear emulsions. Observed asymmetries in left versus right scattering of protons with energies below 14 Mev were used, in conjunction with phase shifts from p-He scattering data, to compute the direction of spin polarization. (auth)

2565

HIGH-ENERGY POTENTIAL SCATTERING. Tai Tsun Wu (Harvard Univ., Cambridge, Mass.). Phys. Rev. 108, 466-9(1957) Oct. 15.

Asymptotically in the limit of high energies, successive approximations are obtained for the problem of potential scattering where the total phase shift through the potential is not small. Only the Schrödinger wave equation is treated. The method consists of first applying the stationary-phase approximation to the integral equation and then solving the results equation by iteration to derive the asymptotic behavior of the field. In particular, some information about the radiation field is obtained. (auth)

2566

SCATTERING OF POLARIZED DIRAC PARTICLES ON ELECTRONS. G. W. Ford and C. J. Mullin (Univ. of Notre Dame, Ind.). Phys. Rev. 108, 477-81(1957) Oct. 15.

The cross section for electron-electron scattering in which the incident and target electrons have arbitrary spin orientations has been evaluated. For the special case in which the spin of the incident electron is polarized along the direction of motion, two different spin effects are obtained. The first of these effects is simply a dependence of the cross section on the relative spin orientation; the second effect corresponds to an up-down asymmetry in the cross section. Similar effects have been obtained for the scattering of polarized positrons on polarized electrons. The depolarization of electrons and muons in scattering on unpolarized electrons also has been considered. For electrons which lose an appreciable fraction of their initial energy in passing through matter, the depolarization is appreciable. If the fractional energy loss is small the depolarization is proportional to the fractional energy loss. For nonrelativistic muons the depolarization which occurs as they are brought to rest in matter is found to be negligible. (auth)

2567

DISPERSION RELATIONS FOR SCATTERING AND PHOTOPRODUCTION. B. L. Ioffe. Soviet Phys. JETP 4, 534-44 (1957) May.

A derivation is given of the dispersion relations for the following problems: scattering of pions by nucleons (excluding the case of scattering at small but nonzero angles), photoproduction of pions on nucleons, scattering of nucleons and antinucleons by nucleons. The method of consideration is based on the general requirement of the impossibility of the propagation of signals with velocities exceeding that of light, and does not make use of the concept of the S matrix for demonstration of the analytical properties of the scattering amplitude. The issue is decided as to whether requirement of microcausality is a necessary condition for

the validity of the dispersion relations and it is pointed out that for certain types of violation of causality, the dispersion relations are preserved. (auth)

2568

ELASTIC (p-p)-SCATTERING AND PECULIARITIES OF INTERACTION BETWEEN PIONS AND NUCLEONS. L. M. Soroko. Soviet Phys. JETP 4, 579-80(1957) May.

Strong interaction between a pion and a nucleon may develop in the process of elastic (p-p)-scattering. It is concluded that the peculiarities in this scattering are dependent on the mechanism inevitably produced as a result of the known optical relationship between elastic and inelastic processes. (M.H.R.)

2569

DIFFRACTION SCATTERING OF HIGH-ENERGY PHOTONS BY NUCLEI. V. B. Berestetskii and E. V. Kuznetsov. Soviet Phys. JETP 4, 610-11(1957) May.

Using general diffraction relations for polarized nuclei, it is pointed out that the cross section for scattering σ_s is $\sigma_s = 9\sigma_c^2/(32\pi R^2)$. The diffraction scattering is compared with scattering of photons by a Coulomb field. (M.H.R.)

2570

CONCERNING THE IMPULSE APPROXIMATION. I. M. Shmushkevich (Leningrad Physico-Technical Inst.). Soviet Phys. JETP 4, 611-12(1957) May.

The limitations and advantages of the impulse approximation in examining the problem of the scattering of a particle by a system of two scatterers with zero-range forces are discussed. The results for the differential and total cross sections are compared. (M.H.R.)

Radiation Effects

2571 AD-125271

Inland Testing Labs., Morton Grove, Ill.

RESEARCH TO DETERMINE THE EFFECTS OF NUCLEAR RADIATION ON SEMICONDUCTOR ELECTRONIC COMPONENTS. Scientific Report No. 2 (Second Quarter). M. A. Xavier. Feb. 18, 1957. 157p. Contract AF33(616)-3776.

The results of tests to determine the effects of radiation on semiconductor electronic components are presented. The results on diodes are discussed briefly with reference to an equivalent circuit. Effects of irradiations on transistors yielded relatively consistent behavior. (auth)

2572 WAPD-127(Pt. IV)

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

DEVELOPMENT AND PROPERTIES OF URANIUM-BASE ALLOYS CORROSION RESISTANT IN HIGH TEMPERATURE WATER. PART IV. RADIATION STABILITY OF URANIUM-BASE ALLOYS. M. L. Bleiberg, J. D. Eichenberg, R. H. Fillnow, and L. J. Jones. May 1957. 117p. Contract AT-11-1-GEN-14. $3.25(OTS).

The effects of pile irradiations on the physical properties and corrosion resistance of U–Mo, U–Nb; and U–Si alloys are reported. The dimensional stability under irradiation of the gamma phase U–Mo and U–Nb alloys is excellent; however, an isotropic volume increase of 4 to 6% per wt. % burnup may limit the ultimate fuel element life. Corrosion resistance of the gamma-phase alloys appears to be improved when subjected to a neutron field; this is attributed to an irradiation induced stabilization of the gamma phases. The U_3Si alloy, on the other hand, suffered severe deterioration, particularly of corrosion resistance. Changes in electrical resistivity, hardness, mechanical properties, and crystal structure are presented and the mechanisms producing the observed changes discussed. (auth)

Radioactivity

2573 TID-7537(Pt. 1)

Division of Nuclear Materials Management, AEC and New York Operations Office, AEC.

CONTROL OVER SOURCE AND SPECIAL NUCLEAR MATERIAL. A Symposium Held at New York, March 5-7, 1957. 107p. $3.00(OTS).

Topics discussed include: AEC pricing policy and billing procedures for radioactive source and nuclear materials; material control procedures used during the Experimental Breeder Reactor fuel fabrication; application of in-line instrumentation for process control of uranium processes; accountability policy, practice, and organization at Mallinckrodt Chemical Works; accountability records and measurements; accountability analytical techniques; statistical applications to material control problems; meeting the accountability problems of a research and engineering laboratory; development and practice of materials control in a research reactor; development and practice of materials control in the processing of spent reactor fuel; SS material balances employed in the decontamination and recovery processes at the Goodyear Atomic Corporation's Portsmouth plant; and material control problems associated with chemical processing of irradiated uranium. (C.H.)

2574

CONVERSION ELECTRON SPECTRA OF NEUTRON DEFICIENT ISOTOPES OF THULIUM. K. Ya. Gromov, B. S. Dzhelepov, and B. K. Preobrajenskii (Khlopin Radium Inst.). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 21, 918-39 (1957) July. (In Russian)

2575

DECAY SCHEME OF Pb^{212}. E. M. Krisyouk, A. G. Sergeyev, G. D. Latyshev, and V. D. Vorobyov (V. N. Obraztov Inst. of Railway Engineering, Leningrad). Nuclear Phys. 4, 579-88(1957) Oct.

The decay scheme of $Pb^{212} \xrightarrow{\beta} Bi^{212}$ is analyzed. It is shown that Bi^{212} has the following levels: 0 kev–1^-, 239 kev–0^-, 300 kev–1^-, 415 kev–0^-. The spin and parity assignments are based on the γ-transition multipolarities and computed log τf values for β-transitions. Configurations which can be ascribed to the levels on basis of the shell model qualitatively explain the γ-transition intensities. The proposed decay scheme implies that the 177 kev transition is an E0-transition; this is compatible with presently available data. (auth)

2576

SELECTION RULES FOR BETA AND GAMMA PARTICLE TRANSITIONS IN STRONGLY DEFORMED NUCLEI. G. Alaga (Univ. of Zagreb, Yugoslavia). Nuclear Phys. 4, 625-31(1957) Oct.

A complete list of selection rules for beta and gamma particle transitions in strongly deformed nuclei is given. For the beta decay the list covers all transitions up to the second forbidden ones, while for the gamma decay the selection rules are given for the electric and magnetic dipole, quadrupole, and octupole transitions. References to the papers making use of the selection rules in classifying nuclear states and explaining relative beta and gamma intensities are given at the end of the article. (auth)

2577

DELAYED γ-RAY ANGULAR CORRELATIONS IN TANTALUM 181. R. E. Azuma and G. M. Lewis (The Univ., Glasgow). Phil. Mag. (8) 2, 1325-32(1957) Nov.

The anisotropy of the 133 to 480 kev γ-ray cascade in Ta^{181} has been investigated for liquid sources, using a time-sorting coincidence unit of short resolving time.

The maximum anisotropy has been found to be $-(39 \pm 3)\%$ consistent with the $\frac{1}{2}$(E2) 5/2 (E2 + M1) 7/2 assignment; and evidence has been obtained for attenuation of the correlation in liquid sources. (auth)

2578

DECAY OF EUROPIUM-154. José O. Juliano and F. S. Stephens, Jr. (Univ. of California, Berkeley). Phys. Rev. 108, 341-8(1957) Oct. 15.

The gamma rays and electrons of fission-product europium (Eu^{153}, Eu^{154}, and Eu^{155}) have been studied, and the results obtained for Eu^{154} are presented. Gamma rays belonging to this isotope have been identified at 0.1229 Mev (35%), 0.2480 Mev, 0.593_3 Mev (4%), 0.694_1 Mev ($\leq$3.5%), 0.705_8 Mev ($\leq$3.5%), 0.724_9 Mev (21%), 0.758_9 Mev ($\leq$3.5%), 0.875_3 Mev (13%), 0.998_2 Mev (14%), 1.007 Mev (17%), 1.277 Mev (42%), and ~1.6 Mev (~3%). Beta end points of Eu^{154} were measured at 1.85, 0.87, 0.59, and 0.25 Mev. Multipolarities for most of the above gamma-ray transitions have been suggested on the basis of the measured K-shell conversion coefficients. The decay scheme of Eu^{154} has been deduced, and, in most respects, the resulting levels of Gd^{154} conform well with the Bohr-Mottelson unified nuclear model and with other even-even nuclei in the strong-coupling regions. (auth)

2579

ABSENCE OF INTERFERENCE EFFECTS IN THE β DECAY OF POLARIZED Co^{56} AND Co^{58} NUCLEI. E. Ambler, R. W. Hayward, D. D. Hoppes, and R. P. Hudson (National Bureau of Standards, Washington). Phys. Rev. 108, 503-5(1957) Oct. 15.

Shielding

2580

THE ATTENUATION OF GAMMA RAYS AND NEUTRONS IN REACTOR SHIELDS. Herbert Goldstein. Washington, U. S. Atomic Energy Commission, 1957. 306p. Available from U. S. Government Printing Office for $2.00.

A discussion of the fundamentals of shielding is presented; the factors affecting the permissible radiation levels, the sources and characteristics of the radiation to be shielded against, and bulk shielding measurements are discussed. The theoretical or empirical calculation of the attenuation of neutrons and γ rays in shield materials is discussed at length. (M.H.R.)

Spectroscopy

2581 UCRL-3696

California. Univ., Berkeley. Radiation Lab.

SPECTROSCOPY OF HIGH-TEMPERATURE SYSTEMS (thesis). William T. Hicks. Feb. 19, 1957. 92p. Contract W-7405-eng-48. $15.30(ph OTS); $5.40(mf OTS).

An investigation to find which of the electronic states of the C_2 molecule is the ground state is described. (T.R.H.)

2582 UCRL-3697

California. Univ., Berkeley. Radiation Lab.

ABSORPTION SPECTRUM OF THE SO MOLECULE. William T. Hicks. Feb. 20, 1957. 16p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40(mf OTS).

A search was made for the absorption spectrum of the SO molecule corresponding to the emission spectrum assigned to this molecule by Henri and Wolff. Spectrograms were taken under thermal equilibrium conditions with a wide variety of SO_2 and S_2 pressures, but no trace of the SO absorption spectrum was found. However, the heat of formation of SO measured by St. Pierre and Chipman is strong evidence that the lower state of the emission system is the ground state of the SO molecule. A re-evaluation of their data leads to values for D_0 of SO and S_2 of 5.027 $\pm$ 0.050 and 3.3 ev, respectively. (auth)

2583 WADC-TR-57-212

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.

X-RAY EMISSION LINES AND 2θ VALUES FOR LITHIUM FLUORIDE ANALYZING CRYSTAL. [Period covered] February 1956 to March 1957. W. L. Baun and R. E. Brocklehurst. Mar. 15, 1957. 55p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: PROCEDURES FOR THE COMPOSITION ANALYSIS OF AIRCRAFT MATERIALS. (AD-131063).

2584

MODULATION IN NUCLEAR PARAMAGNETIC RESONANCE. R. V. Pound (Harvard Univ., Cambridge, Mass.). Rev. Sci. Instr. 28, 966-7(1957) Nov.

Spectrometers for detection and study of nuclear paramagnetic resonance, except in situations of very high resolution, have widely employed modulation of the applied magnetic field in addition to the means of scanning through a given spectral region. In this way the desired signals after detection are carried by frequencies at and near the modulation frequency and thereby the stability problems often associated with systems depending on amplification of voltages at very low frequencies are avoided. Such modulation is not used in spectrometers designed for resolution of the very fine details of the spectra of some liquids because line broadening of even spurious structure can be produced. The results when such a modulation of high frequencies is compared to all line widths and structure separations are discussed. (A.C.)

Theoretical Physics

2585 NRL-4975

Naval Research Lab., Washington, D. C.

NOTES ON ELEMENTARY QUANTUM STATISTICS. R. C. O'Rourke. June 18, 1957. 219p. Projects NR 540-000 and 540-007.

A brief review of elementary quantum mechanics is given. Other topics included are: statistical mechanics of certain simple systems, the role of transformation functions in quantum statistics, methods for calculating the density of states for quantum mechanical systems, and scattering theory. (M.H.R.)

2586 UCRL-3721

California. Univ., Berkeley. Radiation Lab.

I. THE METHOD OF MOMENTS IN QUANTUM MECHANICS. II. THE π-MESIC DISINTEGRATION OF THE DEUTERON (thesis). Francis R. Halpern. Mar. 18, 1957. 59p. Contract W-7405-eng-48. $9.30(ph OTS); $3.60 (mf OTS).

The classical moment techniques of Tchebycheff, Markov, and Stieltjes were applied to the problem of diagonalizing the Hamiltonian operator. These techniques lead in a natural way to an extension of the Rayleigh-Ritz principle and a series solution for the time-dependent Schrödinger equation. The application of these procedures to several simple problems is considered. An investigation of the higher-order corrections to the mesic disintegration of deuterons is considered. It is found that the corrections are small, quite independently of the description employed. (auth)

2587

SOME PROPERTIES OF COMBINED PC-TRANSFORMA-

TION AND ASSOCIATED SELECTION RULES. P. Roman (Univ. of Manchester). Nuclear Phys. 4, 564-78(1957) Oct.

The transformation rules of the creation and annihilation operators of baryon and lepton fields under a combined charge-conjugation and space-reflection operation are derived, and eigenstates of the corresponding operator are found. Also properties of the "squared" operation are studied, giving a distinction between baryon and lepton fields from which some selection rules are derived. K and π-meson fields are also studied, and some consequences for K decay are investigated. Then, assuming a universal Fermi interaction, it is proved that the number of baryons is conserved if the invariance of the interaction under a combined charge-conjugation and space-reflection transformation is demanded. Some selection rules for allowed processes are also studied. (auth)

2588

COULOMB CORRECTIONS TO DELBRÜCK SCATTERING. F. Rohrlich (State Univ. of Iowa, Iowa City). Phys. Rev. 108, 169-70(1957) Oct. 15.

Observation of Delbrück scattering is most feasible on heavy elements and in the 1 to 3 Mev region, where the Born approximation is expected to be very poor. The Coulomb corrections to the known forward scattering amplitude in Born approximation can be computed with the aid of the dispersion relations, making use of theoretical and experimental knowledge of the total cross section for pair production. Explicit calculations are carried out for a lead target. The results show that the corrections are effectively much smaller than anticipated. In the energy region of interest the corrections to the dispersive amplitude are only a few percent. The corrections to the absorptive amplitude are largest (a factor of two near 1.33 Mev) where this amplitude is negligible compared to the dispersive scattering amplitude. (auth)

2589

ELECTRON SCATTERING CROSS SECTIONS BASED ON THE THOMAS-FERMI THEORY. M. Majewski and T. Tietz (Lodz Univ., Poland). Phys. Rev. 108, 193-6(1957) Oct. 15.

In this paper all known approximations, for the Thomas-Fermi function are considered, by means of which one may calculate in the first Born approximation the scattering amplitudes for a fast electron and the total cross section. (auth)

2590

COLLECTIVE MOTIONS IN NUCLEI BY THE METHOD OF GENERATOR COORDINATES. James J. Griffin (Princeton Univ., N. J. and Inst. for Theoretical Physics, Copenhagen, Denmark) and John A. Wheeler (Princeton Univ., N. J.). Phys. Rev. 108, 311-27(1957) Oct. 15.

For an A-particle system, a trial wave function is constructed of the form $\Psi(x_1, \cdots, x_A) = \int \varphi(x_1, \cdots, x_A; \alpha) f(\alpha) d\alpha$. The preliminary nucleonic wave function, φ, solves the problem in a "construction potential." This potential depends upon a "deformation parameter" or "generator coordinate," α. The collective wave function, $f(\alpha)$, or "generator function," is folded into φ to produce a system wave function that depends only upon the coordinates, x_i, of the particles. In the integration, the deformation parameters dissolve away. They do not appear in the final state function; they only generate it. No collective coordinates ever come into use nor do such coordinates ever have to be defined. In typical cases when the generator function contains one or more nodes, it generates nodes in the system wave function Ψ of the kind that describe collective kinetic energy. The energy of the system is extremized with respect to choice of the generator function, $f(\alpha)$. No Hamiltonian ever appears except the A-particle Hamiltonian. All nucleons are treated on the same basis whether in or above closed shells. The appropriate variational calculation leads to an integral equation or "generator wave equation" for $f(\alpha)$. This equation is solved in two limiting cases: the quadratic approximation, and the δ-function approximation. An analysis is made of the Peierls-Yoccoz procedure to calculate the effective-mass parameter in cases where the forces acting in the system are invariant with respect to translation or rotation. There is no external machinery to drive the construction potential. The effective inertia constant does not appear likely to agree in general with that calculated for the essentially different problem of particles in such a machine-driven potential, though the latter value is presumably more nearly correct for physical applications. The trial wave function in the method of generator coordinates is designed for simplicity, not for precision. It is applied in the following paper to the dilatational and shape oscillations of O^{16}. (auth)

2591

STATISTICAL TENSORS FOR ORIENTED NUCLEI. M. E. Rose (Oak Ridge National Lab., Tenn.). Phys. Rev. 108, 362-5(1957) Oct. 15.

Some properties of the statistical tensors, which govern the angular distribution of radiation emitted by oriented nuclei, are discussed. The discussion is limited to the case of axial symmetry in the spin-Hamiltonian which produces the orientation. An identification of the irreducible tensors, which define the statistical tensors, with those familiar in spin coupling is made. This also permits the matrix elements of the former tensors to be obtained quite easily. The temperature dependence of the statistical tensors for the case of small spin coupling is discussed. (auth)

2592

THEORY OF PHOTOPRODUCTION OF PIONS FROM NUCLEONS. J. Enoch, R. G. Sachs, and K. C. Wali (Univ. of Wisconsin, Madison). Phys. Rev. 108, 433-45(1957) Oct. 15.

A resonance theory of the pion-nucleon system based on a very general static model is extended to give an expression for the pion photoproduction amplitude. It is found that for photon energies less than 500 Mev there are just two important terms in the amplitude, one of them describing direct photoejection of the pion and the other, photoexcitation of the $J = {}^3/_2$, $I = {}^3/_2$ resonance state of the nucleon. The first term is estimated by means of a weak-coupling, finite-source theory which is made gauge-invariant by introducing line currents in the source. Comparison with the threshold π^+ production leads to a coupling constant (without recoil correction) $f^2 = 0.049$. The behavior of the cross section at high energies does not appear to be consistent with this result. Much better agreement with the data above threshold is obtained for the uncorrected coupling constant $f^2 = 0.07$. However, serious discrepancies within the data make it impossible to resolve this difficulty at present. The behavior of the photoejection part of the π^+ cross section above the resonance is found to be sensitive to the form of the source function. With $f^2 = 0.049$ and a Gaussian source function, infinite cutoff comes closest to fitting the data. However a considerably better fit is obtained with $f^2 = 0.07$ and a cutoff of about 4 pion masses. The resonance term is sensitive to the form of the pion-nucleon phase shift α_{33} above the resonance. We find that the simple one-level form for the energy dependence of α_{33} (Chew-Low curve) is not adequate to account for the data for high-energy photoproduction of pions; it is necessary to take account of the residue of higher resonances. Good agreement with the resonance term is obtained in terms

of just two constant parameters, $\mathcal{M}$, the strength of the resonance matrix element, and Q, the contribution of higher resonances to the phase shift. No supporting evidence for a previously suggested S wave, $I = \frac{1}{2}$ resonance is found. (auth)

2593

RELATIVISTIC CORRECTIONS TO THE POLARIZATION OF PROTONS AT HIGH ENERGIES. Shoroku Ohnuma (Yale Univ., New Haven, Conn.). Phys. Rev. 108, 460-2(1957) Oct. 15.

Relativistic corrections to high-energy p-p polarization data are calculated, with a breakdown of contributions into parts corresponding to the anomalous proton magnetic moment and remaining effects. It is found that as much as 70% of the relativistic correction may be caused by the anomalous part of the proton moment. In view of the presence of wave function distortion effects and the difference in sensitivity of different parts of the correction to the appreciable wave function distortion effects recently pointed out by Breit, it is concluded that the values of the relativistic corrections to polarization are at present quite unreliable. On the other hand, the corrections are smaller than the experimental error in many cases and their unreliability does not appear to affect existing fits to data seriously. (auth)

2594

CENTER-OF-MASS MOTION IN MANY-PARTICLE SYSTEMS. S. Gartenhaus and C. Schwartz (Stanford Univ., Calif.). Phys. Rev. 108, 482-90(1957) Oct. 15.

An explicit construction is found for a unitary operator which insures the free motion of the center of mass of any many-particle wave function on which it is allowed to act. The transformation is used to calculate recoil correction terms for the internal energy and external interactions of nuclei, and some numerical evaluations are given for cases of interest. The many-body harmonic-oscillator problem is exactly soluble when one uses the transformation, and one is thus enabled to give a more general discussion of the spurious states. (auth)

2595

TIME REVERSAL IN NUCLEAR INTERACTIONS. E. M. Henley (Univ. of Washington, Seattle and Brookhaven National Lab., Upton, N. Y.) and B. A. Jacobsohn (Univ. of Washington, Seattle). Phys. Rev. 108, 502-3(1957) Oct. 15.

2596

REMARKS ON BILOCAL FIELD THEORY. G. Raiski (Copernicus Univ., Torun, Poland). Soviet Phys. JETP 4, 577-8(1957) May.

A reply is made to V. A. Zhirov's three arguments against a previously proposed bilocal field theory. (M.H.R.)

2597

CONSEQUENCES OF THE RENORMALIZABILITY OF QUANTUM ELECTRODYNAMICS AND MESON THEORY. V. V. Sudakov. Soviet Phys. JETP 4, 616-17(1957) May.

The consequences of the renormalizability of quantum electrodynamics and meson theory which were obtained by Gell-Mann and Low and Bogoliubov are more easily formulated, starting with three equations of Gell-Mann and Low. (M.H.R.)

Tritium and Tritium Compounds

2598

MOLECULAR DISSOCIATION FOLLOWING RADIOACTIVE DECAY: TRITIUM HYDRIDE. Arthur H. Snell, Frances Pleasonton, and H. E. Leming (Oak Ridge National Lab., Tenn.). J. Inorg. and Nuclear Chem. 5, 112-17(1957).

When radioactive decay takes place in the TH molecule, the resulting $(He^3H)^+$ ion shows a strong tendency to remain bound. When dissociation does take place, the electrons most commonly divide one with each nucleus, rather than both going either with the He^3 fragment or with the H fragment. These conclusions are derived from a magnetic analysis of the ions produced as the result of TH decay, the observed relative intensities being as follows: $(He^3H)^+$, 93.2 ± 1.9%; $(He^3)^+$, 5.1 ± 0.3%; H^+, 1.55 ± 0.16%; $(He^3)^{++}$, 0.14 ± 0.01%. The molecule loses an electron in fewer than 1.7% of the decay events. (auth)

Uranium and Uranium Compounds

2599 AERE-R/M-133

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE EFFECTIVE TEMPERATURE OF THERMAL NEUTRONS IN A SINGLE ROD OF NATURAL URANIUM. P. N. Cooper. July 1957. 14p. (NPCC/RPWP/P-69).

A cylinder of natural uranium 1.2 in. outside diameter was inserted in a block of graphite which thermalized a beam of neutrons from BEPO. The counting rates of U^{233} U^{235}, and Pu^{239} fission chambers inside the uranium were measured. Several uranium cylinders with inside diameters ranging from 0.9 in. to 0.44 in. were investigated, and the variation of the ratios of the counting rates with wall thickness was found. These ratios indicate that the effective neutron temperature increases by only 15°C from the moderator to the maximum thickness of uranium. A discussion is included which shows how the peak of a Maxwellian may be shifted to a higher energy by adsorption with only a small increase in the effective neutron temperature. (auth)

2600 IGC-TRDC/P-151

United Kingdom Atomic Energy Authority. Industrial Group H. Q., Risley, Lancs, England.

A NOTE ON THE YIELD OF ALPHA–URANIUM UNDER IRRADIATION. J. H. Bowen. [1955?]. 7p.

An attempt is made to deduce the macroscopic growth rate under irradiation from the growth rate of a single crystal and the stress-strain data. (auth)

2601

DETERMINATION OF URANIUM-235 BY GAMMA SCINTILLATION SPECTROMETRY. George H. Morrison and James F. Cosgrove (Sylvania Electric Products Inc., Flushing, N. Y.). Anal. Chem. 29, 1770-1(1957) Dec.

A method for determination of U^{235} is based on use of gamma scintillation spectrometry to measure 0.143- and 0.184-Mev gamma photons emitted during its natural radioactive decay. Area under photopeaks of unknown is compared to standard sample. Method is rapid and nondestructive and has accuracy and precision within 1% in range 0.72 to 100% U^{235}. (auth)

2602

MAGNETIC ANALYSIS OF THE LONG-RANGE PARTICLES FROM FISSION OF U^{235}. Clyde B. Fulmer and Bernard L. Cohen (Oak Ridge National Lab., Tenn.). Phys. Rev. 108, 370-2(1957) Oct. 15.

The long-range particles from pile-neutron fission of U^{235} were studied with a high-resolution magnetic spectrograph. The particles were detected with a CsI(Tl) crystal scintillator; differential pulse-height analysis was used. Scintillation pulse height vs $H\rho$ data show that the particles have the same value of e^2/m as alpha particles. The range-energy relationship for the particles in aluminum was studied; this showed that the particles have the same value of me^2 as alpha particles. Since the long-range particles have the same e^2/m value and the same me^2 value as alpha particles, they have the same values of e

and m; this confirms that they are alpha particles as was indicated by previous studies. The energy distribution of the particles as determined here is in good agreement with previous determinations by other methods. An extensive search revealed no fine structure in the energy distribution. The shape of the energy distribution indicates that the particles are formed at the instant of fission. (auth)

2603

MEAN EXCITATION ENERGY OF FISSIONING URANIUM NUCLEI ON ABSORPTION OF SLOW π^--MESONS. N. S. Ivanova (Academy of Sciences, USSR). Soviet Phys. JETP 4, 597-8(1957) May.

2604

ANGULAR DISTRIBUTION OF THE URANIUM FISSION FRAGMENTS PRODUCED BY HIGH-ENERGY NEUTRONS. V. I. Ostroumov and N. A. Perfilov. Soviet Phys. JETP 4, 603-4(1957) May

It has been shown previously that fragments of heavy nuclei fissioned by either charged or neutral medium energy (up to 20 Mev) particles display a parallel anisotropy relative to the direction of the bombarding beam and this orientation becomes perpendicular for U at incident-proton energies of 460 Mev and higher. Results indicate that the anisotropy in the escape of fragments, the distribution as obtained from the number of particles accompanying the fragments, and the directivity of these particles are approximately the same whether the U nuclei are fissioned by high-energy neutrons or protons of the same energy. (M.H.R.)

PATENTS

Physics

2605

APPARATUS FOR CONTROLLING GAS PRESSURE. (to Schlumberger Well Surveying Corp., Texas). British Patent 779,913. July 24, 1957. Nuclear Power 2, 486 (1957) Nov.

This describes a method of controlling the pressure of hydrogen-type gases such as deuterium in low pressure chambers such as ion sources, accelerators, etc. Basically it comprises two filaments, preferably of zirconium, one of which is initially saturated with the gas to be regulated, and the other substantially outgassed. On heating to a certain predetermined temperature, the first emits the gas, and the other absorbs it on heating. By suitable adjustment of these temperatures, the desired pressure may be maintained. (auth)

2606

IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. R. V. Moore, K. H. Dent, and J. H. Bowen (to United Kingdom Atomic Energy Authority). British Patent 781,648. Aug. 21, 1957. Nuclear Power 2, 486(1957) Nov.

This is the basic patent for the PIPPA design study for a natural-uranium, gas-cooled graphite-moderated power reactor that later became Calder Hall. It apparently covers a core with vertical fuel element channels arranged on a regular lattice in groups with a control rod in the center of each group. The whole core is contained in a pressure vessel and access to the fuel and control rods is from above through standpipes. Heat exchanger and gas circulation systems are described in the specification, as is the burst slug detection system. An interesting point covered is the design of graphite blocks to permit Wigner growth at the same time maintaining the lattice geometry As is well known, the final Calder Hall design was rather different in some respects from PIPPA. In particular the patent specification covers ledges in the graphite fuel channels for separate support of the fuel elements: at Calder this was abandoned in place of straightforward stacking. (auth)

2607

NUCLEAR REACTORS. (to Deutsche Gold-und Silber-Scheideanstalt Vormals Roessler, Frankfurt (Main), Germany). British Patent 782,888. Nuclear Power 2, 486(1957) Nov.

The inventors believe that many advantages are attached to using beryllium as a moderator and separating the cooling ducts from the fuel to pass only through beryllium. It has been found that metallic contact may be made between the fuel and the moderator and simultaneously to prevent penetration of fission products into the coolant. The beryllium is in the form of blocks, of between 10 and 100 kg, preferably welded together. Thermal contact between the moderator and the fuel can be produced by mechanical compression, shrinkage, by casting the liquefied metal into cavities in the beryllium, or by interposing a metallic contact substance. To change the fuel, the whole beryllium block is removed. These are assembled from two parts, brazed together, and can be separated with comparative ease. Several shaped fuel elements, preferably in shapes of small specific surface, can be arranged within one beryllium block. (auth)

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